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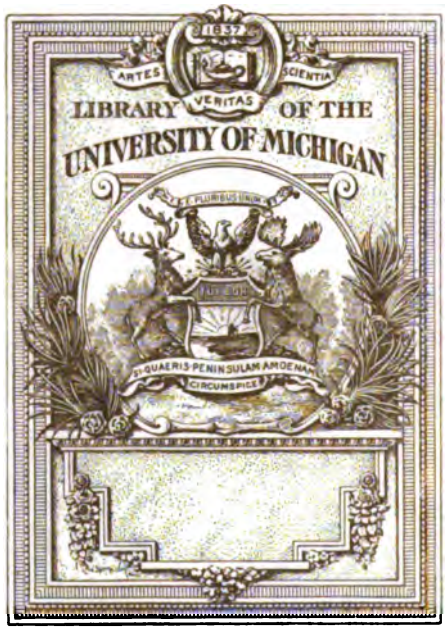
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NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

.....

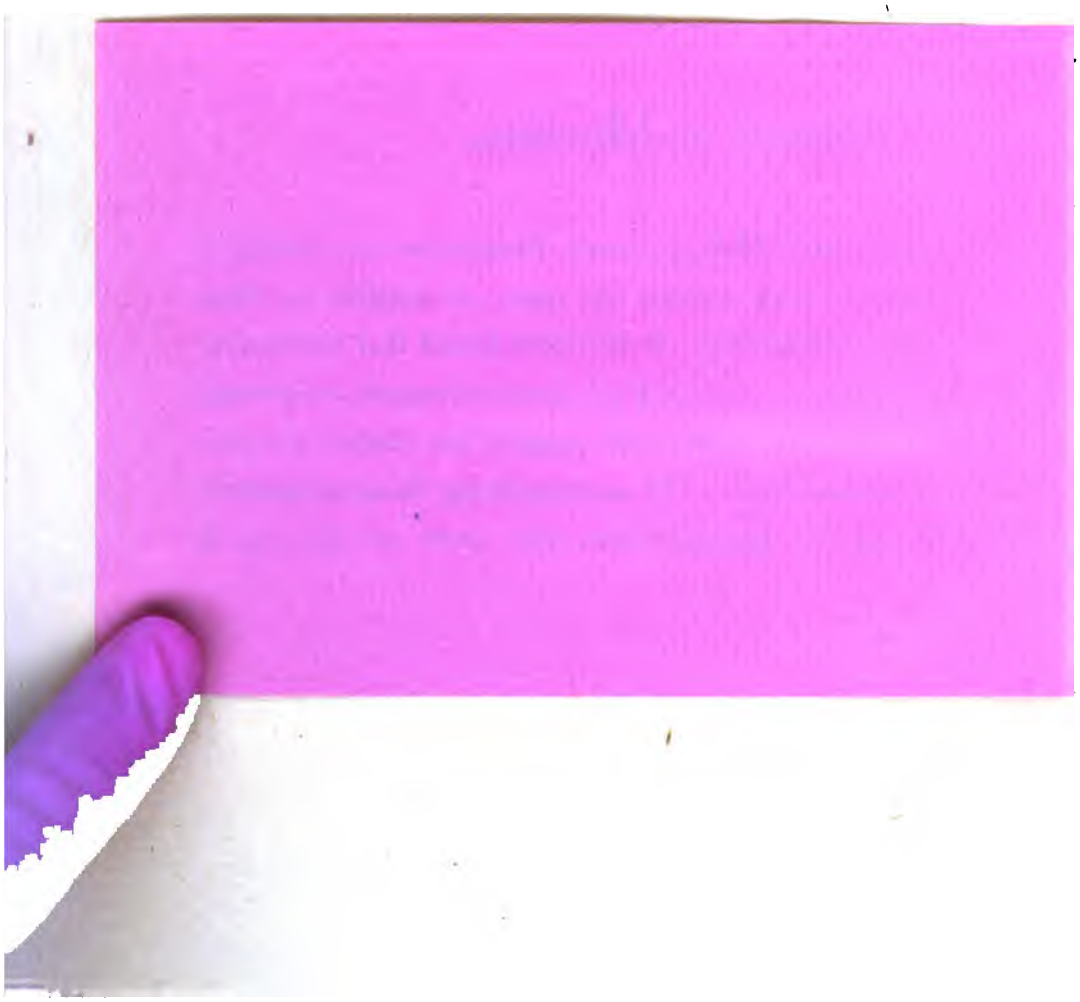
Membership of

.....

Application Received

Notice to Members.

To make the Cotton Manufacturers' Association an absolutely representative body it must include as many as possible of those who are eligible for membership. It has been found that many who were eligible and desired to join had not done so because not invited. It is hoped that every member will present the matter to non-members among his associates. The accompanying blank proposition for membership can be detached from the cover at the row of perforations.



NEW ENGLAND

Cotton Manufacturers' Association.

Proposal for

.....

Membership of

.....

Application Received

.....189 .

Action by Board of Government,.....favorable.

.....189 .

Voted by the Association,.....elected,

.....189 .

New England Cotton Manufacturers' Association.

Founded April 20, 1865. Incorporated December 1, 1894.

ROOM 501 JOHN HANCOCK BUILDING,

No. 178 Devonshire Street, and No. 35 Federal Street.

PROPOSAL FOR MEMBERSHIP.

(When filled out, to be mailed to the Secretary, P. O. Box 3672, Boston, Mass., in time for action by the Board of Government, at least one week before a meeting of the Association.)

Mr. .....

Position, ...

P. O. Address, ...

is proposed for ..... *membership in the* NEW ENGLAND COTTON
active or associate

MANUFACTURERS' ASSOCIATION *by* .....
signature of member proposing candidate.

a member of the Association.

Experience of Applicant, (Please state, in full, particulars of detail, giving names, dates, and nature of work, as fully as convenient.)

.....

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.....

The undersigned certifies that the above statements are correct, and agrees that, if elected to the Association, he will be governed by its rules as long as his connection with it shall continue.

Date, ... 189 .

signature of candidate.

Russell N. Eaton

TRANSACTIONS

OF THE

New England

COTTON MANUFACTURERS' ASSOCIATION.

Founded April 20, 1865. Incorporated Dec. 1, 1894.

NO. 63.

SEMI-ANNUAL MEETING.

HELD AT THE AUDITORIUM OF THE PHILADELPHIA TEXTILE SCHOOL, OCTOBER 27, 28, 1897.

Office of the Association:
501 John Hancock Building, No. 178 Devonshire St., and No. 35 Federal St., Boston, Mass.

WALTHAM, MASS.:
PRESS OF E. L. BARRY,
1898.

ENTERED ACCORDING TO ACT OF CONGRESS
IN THE YEAR 1897
BY THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,
IN THE OFFICE OF THE LIBRARIAN OF CONGRESS
AT WASHINGTON.

By vote of the Board of Government, the price of the *Transactions* is $5.00 per copy to non-members. The price of this issue and the one previous is $1.00 each to members, and the prices of copies previous to Volume 62, is 50 cents to members, but each member is entitled to a copy as a part of the privilege of membership.

CHARTER.

No. 6091.

Commonwealth of Massachusetts.

BE IT KNOWN, That whereas, EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN have associated themselves with the intention of forming a corporation under the name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry, promoting social intercourse among its members; and establishing and maintaining a library of works on textiles in the city of Boston, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer and Directors of said corporation, duly approved by the Commissioner of Corporations, and recorded in this office.

Now, Therefore, I, WILLIAM M. OLIN, Secretary of the Commonwealth of Massachusetts, do hereby certify that said EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN, their associates and successors, are legally organized and established as and are hereby made an existing corporation under the name of the

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

with the powers, rights and privileges, and subject to the limitations, duties and restrictions which by law appertain thereto.

Seal of the Commonwealth of Massachusetts.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed this first day of December, in the year of our Lord one thousand eight hundred and ninety-four.

WILLIAM M. OLIN,
Secretary of the Commonwealth.

157063

Commonwealth of Massachusetts.

(Acts of 1895, Chap. 163.)

AN ACT TO AUTHORIZE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION TO HOLD ITS MEETINGS WITHOUT THE COMMONWEALTH.

Be it enacted, etc., as follows:

SECTION 1. The New England Cotton Manufacturers' Association is hereby authorized to hold its meetings in any state or territory of the United States and in the District of Columbia; provided, however, that its annual meeting shall be held in this Commonwealth at least once in five years.

SECT. 2. This act shall take effect upon its passage. [Approved March 23, 1895.]

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

FOUNDED APRIL 20, 1865.

INCORPORATED DECEMBER 1, 1894.

CONSTITUTION AND BY-LAWS.

ACTIVE MEMBERS.

ARTICLE 1. Any person who is actively engaged as President, Treasurer, Agent, Superintendent or Manager in the manufacture, printing or finishing of cottons shall be eligible for active membership.

ELECTION OF MEMBERS.

ARTICLE 2. All nominations for membership shall be made in writing, at least one week before the date of any regular meeting, and shall be considered by the Board of Government, and reported to the meeting, favorably or adversely, for the action of the Association. *Provided*, that in case the Board shall decide to report adversely upon any nomination, the member who shall have made it shall be informed of the intention so to report, in order that he may have an opportunity to withdraw the name. Upon such report active members may be admitted, if they obtain a majority of votes of the members present and voting therefor, by acceptance in writing, and paying an admission fee of ten dollars, and maintaining their membership by the payment of an annual assessment not exceeding ten dollars. Any member failing to pay two successive assessments shall cease to be a member at the end of six months from the date when such second assessment shall become due. Any member may withdraw from the Association upon payment of all arrearages, first giving notice of his intention so to do, in writing, to the Secretary, and the Board of Government may accept such resignation; and any member may be expelled for cause,

at any regular meeting, two-thirds of the members present voting therefor.

ASSOCIATE MEMBERS.

ARTICLE 3. Persons engaged in the manufacture of cotton or cotton fabrics, or the manufacture of textile machinery, or industries kindred to the cotton manufacture, may become associate members of the Association. The methods of application, nomination, election and withdrawal from the Association being under the same conditions as those provided for active members in Article 2, excepting that this class of membership does not carry with it the privilege of voting or speaking, except by permission from the Board of Government or a vote of the Association to allow permission.

The initiation fee for associate members shall be twenty-five dollars, and the annual assessment shall be double the sum annually voted for active members.

Associate members may be expelled by a majority vote of the Board of Government.

HONORARY MEMBERS.

ARTICLE 4. Honorary members may be elected, when recommended by the Board of Government, at any regular meeting of the Association, who shall be enrolled as such, and shall be entitled to attend the meetings of the Association and participate in its proceedings, without the right to vote. They shall not be subject to payment of admission fees or assessments. No person actively engaged in cotton manufacture shall be eligible to honorary membership.

ARTICLE 5. It shall be the duty of all members of the Association to make returns to the Secretary of such statistics as may be called for by him, under the direction of any committee duly appointed for the collection of statistics, when not incompatible with private interests.

OFFICERS.

ARTICLE 6. The officers of this Association shall be a President, two Vice-Presidents, six Directors, a Treasurer, Secretary, and Auditor of Accounts.

ELECTION OF OFFICERS.

ARTICLE 7. At each annual meeting there shall be chosen by ballot a President, two Vice-Presidents and two Directors; the President and Vice-Presidents to serve one year, and the two Directors shall be chosen for terms of three years.

DUTIES OF OFFICERS.

ARTICLE 8. The President, or in his absence the senior Vice-President present, shall preside at all meetings of the Association and of the Board of Government. All officers shall hold their respective offices until their successors shall be chosen and accept their positions.

ARTICLE 9. The President, Vice-Presidents and Directors shall constitute a Board of Government, and have under their care and direction all matters pertaining to the management of the Association; and five of their number shall constitute a quorum for the transaction of business. Meetings of the board may be called by the President, at such time and place as he may deem expedient, giving each member a written or printed notice of the same at least five days before the day of meeting. At their first meeting the board shall elect a Treasurer, Secretary, and Auditor of Accounts for the year ensuing, and fix the amount of compensation of the Secretary. All vacancies in their board occasioned by death or resignation shall be filled by the board; and the persons so elected shall hold their offices until the next annual meeting. The board may, from time to time, as they shall deem expedient, appoint committees, from among their own board or from the members at large, to collect statistical information, examine new inventions or processes in manufacturing goods, as also to prepare essays on subjects of interest to the Association.

ARTICLE 10. The Treasurer shall keep a book in which all receipts and payments of money shall be entered, collect all moneys due the Association, and disburse the same upon the written order of the Board of Government. At the annual meeting in each year he shall make an exhibit of his accounts, or oftener if the Board of Government require it. He shall notify the members of assessments voted, and cause them to be collected in a reasonable time.

ARTICLE 11. The Secretary shall attend all meetings of the Association and of the Board of Government, and keep accurate records of

their doings. In the absence of the Secretary at any meeting, a Secretary *pro tem.* may be appointed by the presiding officer, who shall be sworn to do all things, while in office, required of the Secretary.

ARTICLE 12. The Auditor shall examine the accounts of the Treasurer annually, and report at each meeting the state of the finances.

MEETINGS.

ARTICLE 13. The annual meeting of the members of the Association shall be held on the last Wednesday of April, or at such other time, and at such hour and place as the Board of Government may appoint. There shall also be a semi-annual meeting of the Association on the last Wednesday of October, in each and every year, or at such other time, and at such place and hour as the Board of Government may appoint.

Special meetings may be called by the Board of Government whenever they deem it expedient, or upon the written application of any ten members, made to the Secretary.

ARTICLE 14. All meetings of the members of the Association shall be in pursuance of a written or printed notice, addressed to each member, with the name of the President or Secretary attached thereto, and deposited in the Post Office ten days at least before the day of meeting, specifying the time and place of meeting; and at all such meetings fifteen members shall constitute a quorum for the transaction of business.

ARTICLE 15. Amendments to the By-Laws may be made at any stated meeting of the Association by a two-thirds vote; *provided*, notice of such proposed amendment be given in writing at a previous meeting, and also notice be given to each member by the Secretary, of the pendency of such amendment, ten days at least before any such meeting.

BOARD OF GOVERNMENT.

1897.

PRESIDENT.

RUSSELL W. EATON, ...	BRUNSWICK, ME.

VICE-PRESIDENTS.

FRED C. McDUFFIE, ...	LAWRENCE, MASS.
HENRY T. WHITIN, ...	NORTHBRIDGE, MASS.

DIRECTORS.

ALBERT F. KNIGHT, ...	QUIDNICK, R. I.
HERBERT L. PRATT, ...	LEWISTON, ME.
STEPHEN A. KNIGHT, ...	PROVIDENCE, R. I.
JOHN ECCLES, ...	TAFTVILLE, CONN.
CHAS. H. RICHARDSON, . . .	CLINTON, MASS.
GEORGE H. HILLS, ...	FALL RIVER, MASS.

AUDITOR.

JACOB H. SAWYER, ...	BOSTON, MASS.

SECRETARY.

C. J. H. WOODBURY, P. O. Box 3672, BOSTON, MASS.

OFFICE OF THE ASSOCIATION:

ROOM 501, JOHN HANCOCK BUILDING, 178 DEVONSHIRE STREET,
BOSTON, MASS.

OFFICERS OF THE ASSOCIATION.

FROM THE FIRST ORGANIZATION.

PRESIDENTS.

Ezekiel A. Straw,	1865–78	Henry F. Lippitt,	1888–89
Amos D. Lockwood,	1878–80	Walter E. Parker,	1889–92
John Kilburn,	1880–83	Robert McArthur,	1892–94
William C. Lovering,	1883–85	Edw. W. Thomas,	1894–95
Richard Garsed,	1885–86	A. M. Goodale,	1895–96
J. S. Ludlam,	1886–88	Arthur H. Lowe,	1896–97
		RUSSELL W. EATON,	1897–

VICE-PRESIDENTS.

Amos D. Lockwood,	1865–77	Walter E. Parker,	1885–89
William A. Burke,	1865–73	Richard B. Borden,	1886–88
John C. Palfrey,	1873–76	Arnold B. Sanford,	1888–91
Edward Atkinson,	1876–78	Robert McArthur,	1889–92
A. G. Cumnock,	1877–80	Simeon B. Chase,	1891–93
Charles Nourse,	1878–81	E. W. Thomas,	1892–94
William F. Goulding,	1880–83	A. M. Goodale,	1893–95
Richard Garsed,	1881–85	William J. Kent,	1894–97
J. S. Ludlam,	1883–86	FRED. C. McDUFFIE,	1895–
		HENRY T. WHITIN,	1897–

DIRECTORS.

J. S. Davis,	1865–69	A. M. Wade,	1868–69
Charles Nourse,	1865–78	D. J. Johnston,	1869–70
Phineas Adams,	1865–74	A. G. Cumnock,	1869–77
William P. Haines,	1865–69	F. E. Clarke,	1869–75

DIRECTORS.—Concluded.

Thomas J. Borden,	1865–78	William P. Haines,	1874–78
Daniel D. Crombie,	1865–68	Robert McArthur,	1886–89
Cyrus I. Barker,	1875–80	S. S. Spencer,	1887–90
Hervey Kent,	1877–81	E. W. Thomas,	1888–92
David J. Johnston,	1878–82	William W. Whitin,	1888–93
Walter Paine, 3d,	1878–80	Robert R. Smith,	1889–92
Chas. L. Lovering,	1878–83	Alfred M. Goodale,	1890–93
Richard Garsed,	1880–81	William J. Kent,	1891–94
William H. Jennings,	1880–83	Herman F. Straw,	1891–93
Chas. D. McDuffie,	1881–83	Fred C. McDuffie,	1892–95
Walter E. Parker,	1881–85	George W. Bean,	1892–95
John W. Danielson,	1881–85	F. M. Messenger,	1893–95
William E. Barrows,	1882–83	Arthur H. Lowe,	1894-96
Rufus A. Maxfield,	1883–86	Henry T. Whitin,	1894–97
George W. Weeks,	1883–86	Russell W. Eaton,	1896–97
Henry S. Howe,	1883–87	ALBERT F. KNIGHT,	1893–
Richard B. Borden,	1883–86	JOHN ECCLES,	1895–
O. S. Brown,	1885–91	HERBERT L. PRATT,	1895–
Henry F. Lippitt,	1885–88	STEPHEN A. KNIGHT,	1895–
Wilbur A. Stiles,	1886–88	C. H. RICHARDSON,	1897–
Stephen N. Bourne,	1886–91	GEORGE H. HILLS,	1897–
John Kilburn,	1870–80		

AUDITORS.

Benjamin Saunders,	1865–71	Henry D. Sullivan,	1873–82
John C. Palfrey,	1871–73	JACOB H. SAWYER,	1882

SECRETARY AND TREASURER.

Ambrose Eastman,	1865–94	C. J. H. WOODBURY,	1894

MEMBERS OF THE ASSOCIATION.

November 1, 1897.

Members of the Association are respectfully requested to scrutinize the following list, and advise the Secretary, P. O. Box 3672, Boston, Mass., of change in address, of any error in regard to their names.

As a number of members rejoined the Association after severing their first membership, the date of their earliest election is given.

HONORARY MEMBERS.

George Arms	Grand Hotel	New York City	Oct. 16, 1872.
Jones S. Davis	397 Maple St.,	Holyoke, Mass.	Oct. 27, 1897.
Ambrose Eastman	53 State St.	Boston, Mass.	Sept. 27, 1894.
Samuel Webber	Hydraulic Engineer	Charlestown, N. H.	Apr. 28, 1897.

ACTIVE MEMBERS.

Alfred E. Adams	Supt. Linwood Mills	Whitinsville, Mass.	Apr. 27, 1887.
John S. Adams, Jr.	Supt. Adams Bros. Mfg. Co. 35 Grove St.,	Adams, Mass.	Apr. 29, 1896.
Stephen L. Adams	Treas. Stafford Mfg. Co.	Central Falls, R. I.	Apr. 24, 1895.
Joseph D. Aiken	Ponemah Mills	Taftville, Conn.	Oct. 28, 1891.
F. S. Akin	Supt. Cornell Mills	Fall River, Mass.	Sept. 27, 1894.
Charles T. Aldrich	Treas. Aldrich Mfg. Co. Box 34,	Providence, R. I.	Apr. 28, 1886.
George E. Ames	Mech. Supt. Lawrence Mfg. Co.	Lowell, Mass.	Apr. 24, 1895.
William Ames	Treas. Fletcher Manufg. Co., Box 83, 47 Charles St.,	Providence, R. I.	Apr. 30, 1879.
Charles B. Amory	Treas. Hamilton Manufg. Co. 70 Kilby St.,	Boston, Mass.	Apr. 25, 1894.
Thomas Armstrong	Supt. No. Pownal Mfg. Co.	No. Pownal, Vt.	Oct. 27, 1897.
John W. Arrington	Treas. & Agt. Edna Cotton Mills	Reidsville, N. C.	Oct. 24, 1895.
Abel T. Atherton	A. T. Atherton Machine Co.	Pawtucket, R. I.	Oct. 16, 1872.
Edward Atkinson	Prest. Boston Mfrs. Mu. Fire Ins. Co. 31 Milk St.,	Boston, Mass.	Apr. 19, 1871.

Edward W. Atkinson	Stoddard, Haserick, Richards Co. 152 Congress St.,	Boston, Mass.	Oct. 27, 1886.
H. C. Atwood	Treas. Williamsville Manufg. Co.	Providence, R. I.	Apr. 29, 1885.
James A. Atwood	Agt. Wauregan Mills and Quinebaug Co.	Wauregan, Conn.	Oct. 28, 1891.
John Walter Atwood	Supt. Wauregan Mills	Wauregan, Conn.	Oct. 24, 1895.
W. E. Atwood	Secy. and Asst. Treas. Williamsville Manufg. Co.	Killingly, Conn.	Sept. 27, 1894.
George A. Ayer	Supt. City Manufg. Corporation	New Bedford, Mass.	Apr. 24, 1895.
Charles L. Bailey	Gen. Supt. Boston Manufg. Co. Box 143,	Waltham, Mass.	Sept. 27, 1894.
Henry A. Bailey	Agt. Chicopee Manufg. Co.	Chicopee Falls, Mass.	Oct. 25, 1893.
Edwin H. Baker	Bliss, Fabyan & Co.	Box 2899, New York City, N. Y.	Apr. 24, 1878.
Philip S. Baker	Sec. and Treas. Crowders Mountain Cotton Mills	Kings Mt., N. C.	Oct. 24, 1895.
Edward R. Ballou	Supt. Brighton Mills	540 West 23rd St., New York City	Apr. 25, 1894.
William P. Bancroft	Vice-Pres. Joseph Bancroft & Sons Co.	Wilmington, Del.	Oct. 31, 1883.
A. D. Barker	Agt. Avon Manufg. Co.	Lewiston, Me.	Apr. 19, 1871.
Lewis E. Barnes	Supt. Methuen Co.	Methuen, Mass.	Oct. 24, 1895.
William A. Barrell	Agt. Lawrence Duck Co.	Lawrence, Mass.	Apr. 30, 1884.
Edwin N. Bartlett	Supt. Sigourney and Rockdale Mills,	North Oxford, Mass.	Apr. 29, 1891.
Joseph P. Battles	Asst. Mgr. Amer. Drosophore Co., Box 1460 65 Equitable Building,	Boston, Mass.	Oct. 24, 1895.
George W. Bean	Agt. Androscoggin Mills	Lewiston, Me.	Apr. 17, 1872.
Robert Beatty	Robert Beatty & Co. Coral and Adams Sts.,	Philadelphia, Pa.	Oct. 27, 1897.
Truman Beckwith	Treas. Dyerville Manufg. Co.	Box 171, Providence, R. I.	Apr. 27, 1892.
John Bell	Mgr. Smith & Dove Manufg. Co.	Andover Mass.	Oct. 27, 1897.
A. C. Bent	Agt. Safety Seamless Pocket Co.	Taunton, Mass.	Oct. 27, 1897.
W. N. Blackstone	Treas. Attawaugan Co.	Norwich, Conn.	Apr. 29, 1896.
William W. Blades	Gen. Supt. Lorraine Mfg. Co.	Pawtucket, R. I.	Oct. 25, 1893.
T. Ashby Blythe	Proprietor Ashby Cotton Mills 114 Chestnut St.,	Philadelphia, Pa.	Oct. 27, 1897.
John P. Bodge	Treas. Arkwright Mills	Fall River, Mass.	Oct. 27, 1897.
Nathaniel B. Borden	Treas. Barnard Manufg. Co.	Fall River, Mass.	Oct. 15, 1873.
Richard B. Borden	Treas. Richard Borden Mfg. Co. / Treas. Troy C. & W. Mfg. Co.	Fall River, Mass.	July 18, 1866.
Thomas J. Borden	Pres. Richard Borden Manufg. Co. Box 118,	Fall River, Mass.	Apr. 20, 1865.
E. S. Boss	Agt. Willimantic Linen Co.	Willimantic, Conn.	Oct. 29, 1879.
Stephen N. Bourne	Agt. Stark Mills	Manchester, N. H.	Oct. 21, 1869.
Frank A. Bowen	Supt. Appleton Co.	Lowell, Mass.	Apr. 28, 1897.
Arthur F. Brackett	Supt. Riverpoint and Arctic Mills	Riverpoint, R. I.	Oct. 24, 1895.
Ernest Bridge	Supt. Jas. Chadwick & Bro. Ltd.	Jersey City, N. J.	Apr. 24, 1895.

Christopher P. Brooks	Director Lowell Textile School	Lowell, Mass.	Apr. 28, 1897.
Henry R. Brown	Supt. Hope Co. and Phenix Mill	Phenix, R. I.	Apr. 28, 1897.
James W. Brown	Agt. Warren Cotton Mills	West Warren, Mass.	Oct. 24, 1895.
O. S. Brown	Agt. Salmon Falls Manufg. Co.	Salmon Falls, N. H.	Apr. 21, 1875.
Thomas J. Brown	George Brown's Sons	Mt. Joy, Penn.	Oct. 27, 1897.
E. C. Bucklin	Treas. Interlaken Mills, Treas. Harris Mfg. Co.	Box 289, Providence, R. I.	Apr. 25, 1883.
Robert Burgess	Supt. Pierce Mfg. Corp.	New Bedford, Mass.	Apr. 27, 1892.
Edward N. Burke	Lowell Machine Shop	Lowell, Mass.	Apr. 28, 1880.
W. R. Burnham	Treas. Uncasville Manufg. Co.	Norwich, Conn.	Apr. 29, 1885.
William D. Cadwell	Agt. Nashua Mfg. Co. & Jackson Co.,	Nashua, N. H.	Apr. 19, 1871.
John P. Campbell	Supt. New York Mills,	New York Mills, Oneida Co., N. Y.,	Sept. 22, 1896.
Byron F. Card	Agt. Howland Mills	New Bedford, Mass.	Apr. 25, 1888.
Arnold B. Chace, Jr.	Agt. Valley Falls Co. Woonsocket Mills	Valley Falls, R. I.	Apr. 24, 1895.
George A. Chace	Treas. Bourne Mills	Fall River, Mass.	Apr. 25, 1877.
H. S. Chadwick	Pres. Dover Yarn Mill, Pres. Dilling Cotton Mills	Charlotte, N. C.	Apr. 24, 1895.
Simeon B. Chase	Treas. King Philip Mills	Fall River, Mass.	Apr. 21, 1875.
Clarence N. Childs	Asst. Supt. Hamilton Manufg. Co.	43 Pine St., Lowell, Mass.	Apr. 24, 1895.
Elmer G. Childs	Agt. Boston Duck Co.	Bondsville, Mass.	Oct. 26, 1892.
Jno. H. C. Church	Asst. Treas and Sec. Monument Mills,	Gt. Barrington, Mass.	Apr. 28, 1897.
Alfred Clarke	Eastern Electric Light and Storage Battery Co.	Lowell, Mass.	Apr. 30, 1879.
Ernest E. Clark	Supt. Sutton Manufg. Co.	Wilkinsonville, Mass.	Apr. 29, 1896.
Frederick E. Clarke	Agt. Pemberton Co., Agt. Methuen Co.	Lawrence, Mass.	Apr. 20, 1865.
George A. Clark	Supt. Manchester Mills	Manchester, N. H.	Oct. 25, 1882.
Jeremiah Clark	Textile Machinery	277 Dutton St., Lowell, Mass.	Oct. 15, 1873.
E. N. Clemence	Sec. and Treas. Eagle & Phenix Mfg. Co. and Agt. for Receivers	Columbus, Ga.	Apr. 28, 1897.
W. H. Cloher, Jr.	Treas. Utica Cotton Co.	Capron, Oneida Co., N. Y.	Sept. 22, 1896.
Alonzo A. Coburn	Treas. Atherton Machine Co.	Lowell, Mass.	Apr. 25, 1888.
Josiah G. Coburn		Newton, Mass.	Apr. 20, 1865.
John A. Collins	Supt. American Linen Co.	73 Cottage St., Fall River, Mass.	Oct. 31, 1883.
Frank B. Comins	Vice-Pres. and Gen. Mgr. U. S. Aerphor Co.	P. O. Box 1555, Providence, R. I.	Oct. 28, 1891.
John J. Connell	Supt. Cohannet Mills	Taunton, Mass.	Apr. 27, 1892.
Alphonse S. Covel	Treas. Tremont and Suffolk Mills	P. O. Box 1716, Boston, Mass.	Oct. 31, 1877.
P. T. Creed	Supt. Hopewell Mills	Taunton, Mass.	Sept. 22, 1896.
John B. Cudlip	Supt. Gibson Cotton Mills	Marysville, N. Bruns.	Apr. 28, 1897.
H. H. Culver	Supt. Elizabeth Poole Mill	Taunton, Mass.	Apr. 28, 1897.
Henry S. Culver	Supt. Westville Cotton Mill	Taunton, Mass.	Apr. 28, 1897.

A. G. Cumnock	Agt. Boott Cotton Mills	Lowell, Mass.	Oct. 28, 1885.
Andrew J. Currier	Mgr. Albion and Valley Falls Co.	Valley Falls, R. I.	Apr. 25, 1888.
T. B. Dallas	Treas. Phœnix Cotton Mills Treas. Dallas Manufg. Co.	Nashville, Tenn. Box 8386	Oct. 24, 1895.
Woodbury K. Dana	Treas. Dana Warp Mills	Westbrook, Me.	Apr. 25, 1888.
Albert W. Danforth	Supt. & Chief Engineer Shanghai Cot. China	Cloth Co., Shanghai, 881 Bridge St., Lowell, Mass.	Apr. 27, 1881.
A. Lockwood Danielson	Asst. Treas. Quinebaug Co., Box 900,	Providence, R. I.	Sept. 27, 1894.
J. DeForest Danielson	Asst. Treas. Lockwood Co.	Providence, R. I.	Sept. 27, 1894.
John W. Danielson	Treas. Lockwood Co.	Box 900, Providence, R. I.	Jan. 15, 1868.
B. D. Davol	Pres. Barnard Mfg. Co.	P. O. Box 418, Fall River, Mass.	Apr. 25, 1877.
James C. Deane	Supt. Griswoldville Manufg. Co.	Griswoldville, Mass.	Apr. 25, 1894.
George DeForest	Treas. Mohawk Valley Mills Treas. Utica Steam Cotton Mills	Utica, New York	Oct. 27, 1897.
William P. Dempsey	Agt. Dempsey Bleachery and Dye Works,	Pawtucket, R. I.	Apr. 28, 1886.
Charles W. Dennett	Agt. Johnson Manufg. Co. Agt. Dunbar Mills Co.	North Adams, Mass.	Oct. 29, 1890.
Edward P. Dennis	Lowell Machine Shop	Lowell, Mass.	Apr. 25, 1888.
Charles A. Denny	Vice-Pres. and Gen. Mgr. American Card Clothing Co.	Leicester, Mass.	Apr. 25, 1888.
P. Y. DeNormandie	Supt. Potomska Mills	New Bedford, Mass.	Apr. 29, 1896.
Charles Owen Dexter	Mgr. Canadian Col'd Cot. Mills, Ltd.	Hamilton, Ont.	Apr. 24, 1895.
John W. Dickinson	Supt. Lyman Mills	Holyoke, Mass.	Oct. 27, 1897.
F. Dilling	Sec'y & Treas. Dilling Cotton Mills	Kings Mountain, N. C.	Oct. 24, 1895.
Albert W. Dimick	Agt. Indian Head Mills of Alabama,	Cordova, Ala.	Apr. 25, 1894.
Eben S. Draper	Agt. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George A. Draper	Treas. Draper Co.	Hopedale, Mass.	Oct. 31, 1888.
George Otis Draper	Sec'y Draper Co.	Hopedale, Mass.	Apr. 24, 1895.
William F. Draper	Pres. Draper Co.	Hopedale, Mass.	July 17, 1867.
William F. Draper, Jr.	Draper Co.	Hopedale, Mass.	Oct. 29, 1890.
John Drowne	Supt. Cocheco Mfg. Co.	Dover, N. H.	Apr. 29, 1896.
Joseph M. Dunham	Supt. Merrick Thread Co.	190 Walnut St., Holyoke, Mass.	Oct. 26, 1892.
David H. Dyer	Mill Engineer	7 and 8 Pocassett Bank Building, Fall River, Mass.	Oct. 18, 1871.
William A. Eastman	Treas. Lowell Hosiery Co.	Lowell, Mass.	Apr. 24, 1878.
Russell W. Eaton	Agt. Cabot Manufg. Co.	Brunswick, Me.	Oct. 26, 1887.
John Eccles	Supt. Ponemah Mills	Taftville, Conn.	Apr. 27, 1892.
D. M. Ehrlich	Treas. Galveston Cotton Mills	Galveston, Texas.	Apr. 24, 1895.
Lawrence V. Elder		Dickinson, Texas	Oct. 27, 1886.
Oscar Elsas	Vice-Pres. Fulton Bag & Cotton Mills,	Atlanta, Ga.	Apr. 28, 1897.
Frederick W. Ely	Agt. Columbian Manufg. Co.	Greenville, N. H.	Apr. 25, 1888.
H. B. Estes	Agt. Continental Mills	Lewiston, Me.	Apr. 26, 1893.
William Evans	Supt. Richard Borden Mfg. Co.	Fall River, Mass.	Apr. 29, 1896.

C. E. Falls	Sec. and Treas. Enterprise Mills	Kings Mountain, N. C.	Oct. 24, 1895.
Herbert R. Farnum	Supt. Bernon Mills	Georgiaville, R. I.	Apr. 27, 1881.
Charles F. Farrar	Supt. Wm. A. Slater Corp.	Jewett City, Conn.	Oct. 27, 1897.
Frank S. Field	Supt. Massaemit Yarn Mills	Shattuckville, Mass.	Oct. 24, 1895.
William Firth	Mgr. Am. Drosophore Co. 150 Devonshire St.,	Boston, Mass.	Apr. 25, 1888.
Charles H. Fish	Agt. Cocheco Manufg. Co.	Dover, N. H.	Apr. 27, 1887.
Henry E. Fisher	Agt. Atlanta Cotton Mills	Atlanta, Ga.	Oct. 24, 1895.
Herbert Fisher		Taunton, Mass.	Oct. 29, 1879.
William B. Fittz	Supt. West Boylston Manufg. Co.	Oakdale, Mass.	Oct. 26, 1892.
Frederick A. Flather	Foreman Lowell Machine Shop	Lowell, Mass.	Apr. 29, 1891.
M. F. Foster		Milford, N. H.	Apr. 17, 1872.
Philip H. Fowler		Gloucester City, N. J.	Nov. 30, 1881.
Edward W. France	Dir. of Philadelphia Textile School, Broad and Pine Streets,	Philadelphia, Pa.	Sept. 22, 1896.
C. H. Frisbie	Agt. Attawaugan Co.	Norwich, Conn.	Oct. 29, 1890.
William Galey	Pres. Aberfoyle Manufg. Co.	Chester, Pa.	Apr. 28, 1897.
William Gammell	Agt. Berkeley Co.	Providence, R. I.	Oct. 28, 1885.
James G. Garland		Biddeford, Me.	Oct. 29, 1879.
Joshua Garsed	Garsed & Co., Frankford	Philadelphia, Pa.	Oct. 27, 1897.
James A. Gary	Pres. Gary Manufg. Co. 108 W. German St.,	Baltimore, Md.	Apr. 25, 1883.
John Gegenheimer		Old Orchard, Me.	Apr. 30, 1890.
Charles E. Getchell	Supt. Waltham Bleachery and Dye Works 35 Willow St.,	Waltham, Mass.	Oct. 30, 1889.
Daniel Gilligan	Supt. Pocasset and Metacomet Mills	Fall River, Mass.	Apr. 29, 1896.
William C. Godfrey	Agt. Indian Orchard Co.	Indian Orchard, Mass.	Oct. 29, 1890.
Alfred M. Goodale	Treas. Boston Manufg. Co. 50 State St.,	Boston, Mass.	Apr. 25, 1883.
Charles J. Goodwin	Indian Orchard Co.	Indian Orchard, Mass.	Oct. 18, 1871.
Charles H. Gorton	J. P. & E. K. Ray . . 6 S. Main St.,	Woonsocket, R. I.	Apr. 25, 1894.
Marcellus Gould	Agt. Falls Company	Norwich, Conn.	Sept. 22, 1896.
William B. Gowdey	Mill Supplies 40 Clifford St. Box 707,	Providence, R. I.	Apr. 30, 1890.
George P. Grant, Jr.	Treas. Grant Yarn Co.	Fitchburg, Mass.	Sept. 27, 1894.
D. W. Gray	Supt. Skenandoa Cotton Co.	Utica, N. Y.	Oct. 26, 1892.
R. A. Gray	Supt. Rodman Manufg. Co.	Allenton, R. I.	Apr. 24, 1895.
Stephen Greene	Mill Engineer and Architect 131 Devonshire St.,	Boston, Mass.	Oct. 27, 1886.
William C. Greene	Gen. Mgr. Peace Dale Manufg. Co.	Peace Dale, R. I.	Oct. 27, 1886.
Joseph Warren Greene	Supt. Hamilton Web Co.	Hamilton, R. I.	Apr. 29, 1896.
John Gregson	Supt. Merchants Manufg. Co.	Fall River, Mass.	Apr 24, 1895.
Frederick Grinnell	Pres. Gen. Fire Extinguisher Co.	New Bedford, Mass.	Apr. 24, 1878.
Arthur H. Gulliver	Asst. Supt. Lonsdale Co.	Ashton, R. I.	Apr. 24, 1889.
B. F. Guy	Supt. Pelzer Manufg. Co.	Pelzer, S. C.	Apr. 24, 1895.

Frank J. Hale	Agt. Saco and Pettee Machine Shops	Newton Upper Falls, Mass.	Apr. 27, 1892.
Samuel Hale	Vice-Pres. and Gen. Manager Dixie Cotton Mills	La Grange, Ga.	Apr. 29, 1891.
William E. Hall	Supt. Boston Duck Co.	Bondsville, Mass.	Apr. 27, 1892.
Z. D. Hall	Supt. Berkshire Cotton Mfg. Co.	P. O. Box 963, Adams, Mass.	Oct. 29, 1879.
John H. Hambly	Treas. Quidnick Manufg. Co.	49 Westminster St., Providence, R. I.	Apr. 24, 1895.
A. M. Hamilton	Supt. Parker Mills	Fall River, Mass.	Apr. 28, 1897.
John F. Hamlet		P. O. Box 160, Fall River, Mass.	Oct. 31, 1888.
Joseph O. Hannum	Agt. Saratoga Victory Manufg. Co.	Victory Mills, Saratoga Co., N. Y.	Apr. 30, 1890.
Frank Harris	Hamlet Mills	Woonsocket, R. I.	Apr. 24, 1889.
Henry F. Harris	Treas. West Boylston Manufg. Co.	Box 282, Worcester, Mass.	Apr. 30, 1890.
John J. Hart	Supt. Merrimack Print Works	Lowell, Mass.	Apr. 24, 1895.
Samuel E. Hathaway	Supt. Fall River Iron Works Co.	Fall River, Mass.	Sept. 27, 1894.
William Hathaway	Supt. Barnard Manufg. Co.	Fall River, Mass.	Apr. 25, 1894.
William B. Hawes	Treas. No. Dighton Cotton Co.	Fall River, Mass.	Oct. 24, 1895.
Alfred Hawkesworth	Supt. Merchants Cotton Co.	Montreal, P. Q.	Apr. 26, 1893.
Fred Hawkesworth	Asst. Supt. Merchants Cotton Co.	Montreal, P. Q.	Sept. 22, 1896.
Horace L. Hayden	Supt. Charleston Mills	Charleston, S. C.	Apr. 24, 1895.
William Hayes	Agt. Barker Mill	Auburn, Me.	Apr. 30, 1879.
W. G. Henderson	Agt. Shetucket Co.	Norwich, Conn.	Apr. 29, 1896.
James G. Hill		749 Merrimack St., Lowell, Mass.	Jan. 15, 1868.
William R. Hill	Treas. & Agt. Glasgow Manufg. Co.	South Hadley Falls, Mass.	Oct. 25, 1893.
George H. Hills	Treas. Davol Mills & Stephens Mfg. Co.	Fall River. Mass.	Oct. 24, 1895.
Charles H. Hobbs	Agt. Thorndike Co.	Thorndike, Mass.	Apr. 28, 1886.
Louis L. Hohn	Supt. Wm. Clark Co.	122 High St., Westerly, R. I.	Apr. 28, 1897.
John Holland	12 Trackey St.	P. O. Box 96, Dover, N. H.	Oct. 31, 1877.
Gideon F. Holmes	Treas. and Gen. Mgr. Plymouth Cordage Co.	No. Plymouth, Mass.	Oct. 30, 1889.
George W. Holt	Agt. Monohansett Manufg. Co.	Putnam, Conn.	Oct. 29, 1879.
William P. Holt	Agt. William A. Slater Mills Corp.	Box 315, Slatersville, R. I.	Oct. 25, 1893.
George L. Hooper	Mangr. Shaw Stocking Co.	Lowell, Mass.	Apr. 27, 1892.
Jno. Hopkinson	Gen. Mgr. Slayden & Kirksey Woolen Mills	Waco, Texas	Apr. 25, 1883.
Thomas Horsfield	Supt. Hargrave's Mills	Fall River, Mass.	Oct. 27, 1897.
Henry S. Houghton, Jr.	Supt. Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 24, 1895.
W. C. Houston, Jr.	Pres. Hope Mills Manufg. Co.	333 Drexel Building, Philadelphia, Pa.	Apr. 28, 1897.
Elisha H. Howard	Agt. Harris Manufg. Co.	Providence, R. I.	Apr. 25, 1883.
Henry S. Howe	Lawrence & Co.	68 Chauncy St., Boston, Mass.	Oct. 31, 1877.
W. S. Hume	Supt. Dominion Cotton Mills, Ltd.	Montreal, P. Q.	Oct. 29, 1890.
Arthur W. Hunking	Agt. Mass. Mills, in Georgia	Lindale, Floyd County, Ga.	Apr. 24, 1895.

D. Edwin Irving	Treas. The Irving & Leiper Mfg. Co.,	Chester, Pa.	Oct. 27, 1897.
J. E. Jenckes	Treas. E. Jenckes Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Frank A. Jenks	Agt. U. S. Cotton Co.	Central Falls, R. I.	Apr. 28, 1897.
David L. Jewell	Agt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 20, 1865.
David S. Johnston	Treas. Cohoes Iron Foundry & Mach. Co.,	Cohoes, N. Y.	Oct. 28, 1891.
W. T. Jordan	Mgr. Mountain Island Mfg. Co.	Mountain Island, N. C.	Oct. 24, 1895.
Frank E. Kaley	Treas. Morse & Kaley Mfg. Co.	Milford, N. H.	Oct. 24, 1895.
W. E. Keach	Supt. Grant Yarn Co.,	Fitchburg Hotel, Fitchburg, Mass.	Oct. 26, 1892.
Roland R. Kelly	Supt. Williamstown Manufg. Co.	Williamstown Sta., Mass.	Nov. 30, 1881.
Joseph H. Kendrick	Agt. American Supply Co.	Box 850, Providence, R. I.	Apr. 30, 1879.
George E. Kent	Gen. Mgr. Exeter Manufg. Co.	Pittsfield, N. H.	Oct. 31, 1888.
Hervey Kent	Pres. Exeter Manufg. Co.	Exeter, N. H.	Apr. 20, 1865.
Nathaniel B. Kerr	Agt. Grinnell Manufg. Corp.	New Bedford, Mass.	Oct. 26, 1892.
John Kilburn		Belmont, Mass.	Apr. 20, 1865.
Harry W. Kimball	Supt. The Wm. A. Slater Mills Corp.,	Slatersville, R. I.	Oct. 24, 1895.
John M. Kimball	Agt. Slatersville Mills Special Atty. Jewett City Mills	4 Market Square, Providence, R. I.	Oct. 31, 1888.
Benjamin B. Kirk	Supt. Shove Mills	2107 South Main St., Fall River, Mass.	Apr. 28, 1897.
Albert Knight	Supt. Quidnick Mills	Quidnick, R. I.	Apr. 24, 1895.
Albert F. Knight		Quidnick, R. I.	Oct. 27, 1886.
Jesse A. Knight	Supt. Harris Manufg. Co.	Phenix, R. I.	Oct. 26, 1892.
Stephen A. Knight	Agt. Hebron Manufg. Co.	Box 820, Providence, R. I.	Oct. 21, 1868.
Walter B. Knight	Reynolds Manufg. Co.	Davisville, R. I.	Apr. 24, 1889.
Fred Lacey	Supt. Montreal Cotton Co.	Valleyfield, P. Q.	Apr. 24, 1895.
William T. Lang	Agt. Brookside Mills	Knoxville, Tenn.	Apr. 28, 1897.
Walter H. Langshaw	Supt. Dartmouth Manufg. Corp.	New Bedford, Mass.	Apr. 29, 1896.
Elliott Cowdin Lambert	Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 24, 1895.
George H. Law	Supt. Bristol Manufg. Corp.	64 Willis St., New Bedford, Mass.	Apr. 28, 1897.
Abbott F. Lawrence	Treas. Nemasket Mills	Box 848, Taunton, Mass.	Apr. 24, 1895.
Harold Lawton	Gen. Mgr. Warwick Mills	Centreville, R. I.	Oct. 27, 1886.
Evan Arthur Leigh	Textile Machinery	70 Kilby St., Boston, Mass.	Oct. 29, 1890.
John Leiper	Supt. Fitchburg Manufg. Co.	W. Fitchburg, Mass.	Oct. 27, 1897.
J. Colby Lewis	Supt. W. A. Slater Mills Corp.	Jewett City, Ct.	Oct. 26, 1892.
Leontine Lincoln	Pres. Seaconnet Mills	Fall River, Mass.	Apr. 28, 1897.
B. F. G. Linnell	Agt. Greene & Daniels Mfg. Co.	Pawtucket, R. I.	Oct. 27, 1897.
Charles Warren Lippitt,	Treas. Silver Spring B. & D. Co.	Providence, R. I.	Oct. 30, 1878.
Henry F. Lippitt	Agt. Social and Manville Cos.	Providence, R. I.	Apr. 27, 1881.
William H. Loftus	Supt. Clark Thread Co.	Newark, N. J.	Oct. 27, 1897.
Robert W. Lord	Agt. R. W. Lord & Co.	Kennebunk, Me.	Oct. 20, 1869.
Ernest Lovering	Agt. Lyman Mills	Holyoke, Mass.	Apr. 25, 1888.
Henry M. Lovering	Agt. Whittenton Manufg. Co.	Taunton, Mass.	Oct. 27, 1880.

William M. Lovering	Supt. Whittenton Manufg. Co.	Taunton, Mass.	Sept. 27, 1894.
Arthur H. Lowe	Treas. Parkhill Manufg. Co.	Fitchburg, Mass.	Oct. 30, 1889.
David Lowe	Asst. Supt. Parkhill Manufg. Co.	Fitchburg, Mass.	Apr. 24, 1895.
Dudley T. Lyall	Asst. Mgr. Brighton Mills	541 W. 23d St., N. Y.	Sept. 22, 1896.
William L. Lyall	Supt. J. & W. Lyall Loom and Machine Works	540 W. 23d St., New York City	Oct. 26, 1892.
Herbert Lyman	Treas. Hadley Co.	95 Milk St., Boston, Mass.	Oct. 24, 1895.
Otis G. Lynch	Supt. Enterprise Manufg. Co.	Augusta, Ga.	Oct. 24, 1895.
Alvin S. Lyon	Supt. Lowell Manufg. Co.	Lowell, Mass.	Apr. 26, 1882.
James R. MacColl	Treas. Lorraine Manufg. Co.	Pawtucket, R. I.	Apr. 24, 1895.
Charles L. Macomber	Agt. Nemasket Mills	Taunton, Mass.	Apr. 24, 1895.
Charles T. Main	Mech. and Mill Engineer	Exchange Bldg., Boston, Mass.	Oct. 28, 1885.
Charles R. Makepeace	Mill Engineer	Box 973, Providence, R. I.	Apr. 30, 1890.
A. P. Malcolmson	Supt. The Wm. A. Slater Mills Corp.,	Jewett City, Conn.	Oct. 27, 1897.
Arthur B. Mann	J. H. Martin & Co., Box 465,	99 Franklin St., New York	Apr. 25, 1894.
Charles H. Manning	Gen. Supt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Henry F. Mansfield	Gen. Supt. Utica Steam Cotton Mills and Mohawk Valley Cotton Mills	Utica, N. Y.	Apr. 30, 1890.
Paul J. Marrs	Treas. Henderson Cotton Mills	Henderson, Ky.	Oct. 27, 1897.
Albert G. Martin	Supt. Kincaid Manufg. Co. Box 272,	Griffin, Ga.	Apr. 30, 1884.
Henry D. Martin	Mgr. Dominion Cotton Mills Co. Ltd.	Montreal, Canada	Apr. 28, 1897.
Ira J. Martin	Supt. Bozrahville Co., 62 Conant St.,	Pawtucket, R. I.	Oct. 26, 1892.
John R. Mason	Supt. Laurel Lake Mills	439 Middle St., Fall River, Mass.	Apr. 28, 1897.
Philip A. Mathewson	Supt. King Philip Mills	Box 607, Fall River, Mass.	Apr. 24, 1895.
Thomas Mayor	Textile Machinery	Thomas Mayor & Son, 26 Olney St., Providence, R. I.	Oct. 27, 1880.
Robert McArthur	Agt. Pepperell and Laconia Cos.	Biddeford, Me.	Apr. 17, 1872.
Charles D. McDuffie	Agt. Manchester Mills	Manchester, N. H.	Apr. 21, 1869.
Fred C. McDuffie	Treas. Everett Mills and York Manufg. Co.	Box 2963 Boston, Mass.	Oct. 25, 1882.
William G. McLoon	Supt. Barnaby Manufg. Co.	Fall River, Mass.	Apr. 27, 1892.
James H. McMullan	Pres. Saco and Pettee Machine Shops,	Portland, Me.	Apr. 21, 1869.
William P. McMullan	Agt. Naumkeag Steam Cotton Co.	Salem, Mass.	Sept. 27, 1894.
John Tempest Meats	Gen. Supt. Mason Machine Works	Taunton, Mass.	Apr. 27, 1887.
Charles H. Merriman, Jr.	Asst. Supt. Social & Nourse Mills	Woonsocket, R. I.	Apr. 24, 1895.
Frank M. Messenger	Agt. Grosvenor Dale Co.	No. Grosvenor Dale, Conn.	Apr. 27, 1887.
W. H. Miles	Agt. Farwell Mills	Lisbon, Me.	Sept. 22, 1896.
James I. Milliken	Agt. Everett Mills	Lawrence, Mass.	Oct. 26, 1892.
Roscoe S. Milliken	Supt. Pemberton Co.	Lawrence, Mass.	Apr. 29, 1896.
David Milne	C. J. Milne & Sons	Washington Ave. & 11th St., Philadelphia, Pa.	Apr. 28, 1897.
A. B. Mole	Mgr. Greylock Mill	Adams, Mass.	Apr. 24, 1895.
Edward A. Mongeon	Supt. Blackstone Manufg. Co.	Blackstone, Mass.	Apr. 24, 1895.
Fred W. Moore	Agt. Cordis Mills	Millbury, Mass.	Apr. 27, 1892.

Albert H. Morton	Supt. Kitson Machine Co.	Lowell, Mass.	Oct. 28, 1891.
Fred S. Mosher	Supt. Henrietta Mills	Henrietta, Rutherford Co., N. C.	Oct. 24, 1895.
Oliver H. Moulton	Supt. Hamilton Manufg. Co.	Lowell, Mass.	Apr. 20, 1865.
Farquharson J. Muir	Supt. Canadian Col. Cot. Mills Co.	Hamilton, Ont., Can.	Apr. 27, 1892.
William B. Munroe		Garwood, N. J.	Oct. 24, 1895.
Roscius C. Newell	Supt. Palmer Mill	Three Rivers, Mass.	Oct. 24, 1895.
William G. Nichols	Supt. Lancaster Mills	Clinton, Mass.	Oct. 25, 1893.
Franklin Nourse	Agt. Lawrence Manufg. Co.	Lowell, Mass.	Apr. 24, 1878.
Eben H. Nutting	1029 Union St.,	Manchester, N. H.	Oct. 25, 1882.
S. Odenheimer	Treas. Lane Mills	New Orleans, La.	Oct. 25, 1893.
Charles K. Oliver	Treas. Columbia Mills Co.	Columbia, S. C.	Sept. 27, 1894.
Warren M. Orswell	Pres. Orswell and Nockege Mills	Fitchburg, Mass.	Apr. 16, 1873.
J. Edward Osborn	Treas. American Linen Co.	Fall River, Mass.	Apr. 28, 1897.
Oscar L. Owen	Mech. and Mill Eng. Whitin Machine Works	Whitinsville, Mass.	Apr. 25, 1894.
Elmer E. Page	Agt. York Manufg. Co.	Saco, Me.	Apr. 27, 1892.
Francis J. Parker	Treas. Monadnock Mills, 27 Kilby St.,	Boston, Mass.	Jan. 15, 1868.
O. B. Parker	Supt. U. S. Cotton Co.	Central Falls, R. I.	Apr. 24, 1895.
Samuel L. Parker	Supt. Turners Falls Cotton Mills Box 627,	Turners Falls, Mass.	Apr. 29, 1896.
Walter E. Parker	Agt. Pacific Mills, 217 Haverhill St.,	Lawrence, Mass.	Apr. 25, 1877.
John H. Parks	Pres. Wm. Parks & Son, Ltd.	St. John, N. B.	Apr. 24, 1878.
Duncan D. Parmly	Treas. JohnsonMfg. Co. and Dunbar Mills Co. 160 Broadway,	New York, N. Y.	Sept. 22, 1896.
John W. Pead	Agt. Merrimack Manufg. Co. Box 1231,	Lowell, Mass.	Apr. 26, 1893.
James R. Pearce	Supt. Fulton Bag and Cotton Mills 68 So. Boulevard,	Atlanta, Ga.	Oct. 24, 1895.
William C. Peirce	Pres. Elizabeth Mills, 564 Eddy St.,	Providence, R. I.	Apr. 24, 1895.
William D. Pennell	Agt. Hill Manufg. Co.	Lewiston, Me.	Apr. 16, 1873.
Haven C. Perham	Treas. Kitson Machine Co.	Lowell, Mass.	Apr. 30, 1879.
Henry C. Phillips	Supt. H. N. Slater Mills	Webster, Mass.	Apr. 25, 1894.
Andrew G. Pierce, Jr.	Treas. Pierce Manufg. Corp.	New Bedford, Mass.	Apr. 24, 1895.
Moses Pierce	Pres. Aspinook Co. 274 Broadway,	Norwich, Conn.	Oct. 30, 1878.
Reuben Pilling, Jr.	Supt. Granite Mills Co.	Greenville, R. I.	Apr. 29, 1896.
Charles H. Plummer	Agt. Great Falls Manufg. Co.	Somersworth, N. H.	Apr. 25, 1888.
Charles T. Plunkett	Sec. Berkshire Cotton Mfg. Co.	Adams, Mass.	Apr. 28, 1897.
Thomas C. Powell	Banigan Building,	Providence, R. I.	Oct. 30, 1889.
Herbert L. Pratt	Agt. Bates Manufg. Co.	Lewiston, Me.	Oct. 27, 1875.
T. W. Pratt	Pres. West Huntsville Cotton Mills Co.	Huntsville, Ala.	Sept. 22, 1896.
John E. Prest	Gen. Supt. Harmony Mills	Cohoes, N. Y.	Apr. 17, 1872.
M. W. Quinn	Agt. Hamilton Woolen Co.	Amesbury, Mass.	Oct. 27, 1886.

T. G. Ramsdell	Agt. Monument Mills	Housatonic, Mass.	Oct. 30, 1878.
M. A. Rawlinson	Supt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 24, 1895.
Robert Redford	Agt. Arlington Mills	Lawrence, Mass.	Apr. 26, 1882.
James Renfrew	Treas. Renfrew Manufg. Co.	Adams, Mass.	Oct. 18, 1871.
Roscoe C. Reynolds	Agt. Lewiston Machine Co.	Lewiston, Me.	Oct. 25, 1876.
F. H. Rice	Holbrook Mills Box 47,	W. Boylston, Mass.	Apr. 28, 1880.
Charles H. Richardson	Agt. Lancaster Mills	Clinton, Mass.	Apr. 24, 1889.
C. T. Richmond	Mgr. Fustian Dept. Crompton Co.	Crompton, R. I.	Apr. 28, 1897.
W. H. Richmond	Supt. Bibb Mill No. 2	Macon, Ga.	Oct. 27, 1897.
C. W. Rider	Treas. Merrick Thread Co.	Holyoke, Mass.	Apr. 29, 1896.
Charles E. Riley	Textile Machinery Box 2815		
	281 Congress St.,	Boston, Mass.	Apr. 25, 1888.
George W. Robbins	Supt. Barry Cotton Mill	Smithville, Mass.	Apr. 28, 1897.
Charles D. Robinson	Supt. Crompton Co.	Crompton, R. I.	Sept. 27, 1894.
William A. Robinson	Asst. Supt. Social Manufg. Co.	Woonsocket, R. I.	Apr. 29, 1896.
John K. Russell	Gen. Mgr. May's Landing Water P. Co. and Millville Manufg. Co.	Millville, N. J.	Apr. 29, 1891.
Arnold B. Sanford	Agt. Sanford Spinning Co.	Fall River, Mass.	Oct. 25, 1882.
Charles Henry Savage	Supt. Manville Co.	Manville, R. I.	Apr. 26, 1893.
Henry B. Sawyer	Asst. Treas. Newmarket Mfg. Co.		
	45 Milk St.,	Boston, Mass.	Oct. 27, 1897.
J. H. Sawyer	Treas. Newmarket Manufg. Co.		
	Box 2966,	Boston, Mass.	July 19, 1865.
F. C. Sayles	Pres. Ponemah Mills	Pawtucket, R. I.	Oct. 27, 1897.
George H. Sayward	Mgr. Standard Yarn Co.	Oswego, N. Y.	Oct. 29, 1890.
Arnold Schaer	Supt. Warren Manufg. Co.	Warren, R. I.	Apr. 24, 1895.
John Scott	Supt. Willimantic Linen Co.	Willimantic, Conn.	Oct. 29, 1879.
George H. Shapley	Mgr. Silver Lake Co., 78 Chauncy St.,	Boston, Mass.	Apr. 29, 1896.
Frank P. Sheldon	Mill Engineer	Providence, R. I.	Apr. 25, 1894.
Thomas C. Sheldon	Agt. Fitchburg Duck Mills	Fitchburg, Mass.	Oct. 29, 1884.
Willis S. Shepard	Pres. American Net and Twine Co.		
	93 Commercial St.,	Boston, Mass.	Apr. 29, 1896.
William F. Sherman	Agt. Atlantic Cotton Mills, Box A,	Lawrence, Mass.	Apr. 15, 1874.
Charles M. Shove	Treas. Granite Mills Box 45,	Fall River, Mass.	Oct. 27, 1875.
Herbert H Shumway	Treas. Corr Manufg. Co.	Taunton, Mass.	Apr. 26, 1893.
Francis H. Silsbee	Supt. Cotton Dept. Pacific Mills	Lawrence, Mass.	Apr. 27, 1887.
Louis Simpson	Gen. Mgr. Montreal Cotton Co.	Valleyfield, P. Q.	Apr. 24, 1895.
Abbott E. Slade	Treas. Laurel Lake Mills	Fall River, Mass.	Oct. 25, 1893.
Arba C. Slater	Supt. Linwood Mills	Whitinsville, Mass.	Jan. 15, 1868.
Arthur T. Smith	Supt. Langley Manufg Co.	Langley, S. C.	Oct. 24, 1895.
Joel Smith	Supt. The J. P. King Manufg. Co.	Augusta, Ga.	Oct. 24, 1895.
	Supt. Aiken Manufg. Co.	Bath, S. C.	
John Smith	Supt. Chace Mills	Fall River, Mass.	Oct. 27, 1897.
Robert R. Smith	Mgr. Greenwoods Co.	New Hartford, Conn.	Oct. 19, 1870.
William O. Smith	Agt. Easthampton Spinning Co.	Easthampton, Mass.	Apr. 28, 1897.
Ellison A. Smyth	Pres. and Treas. Pelzer Manufg. Co.,	Pelzer, S. C.	Oct. 26, 1892.

William S. Southworth	Agt. Mass. Cotton Mills	Lowell, Mass.	Oct. 31, 1888.
William T. Spear	Supt. Jackson Co.	Nashua, N. H.	Oct. 30, 1889.
S. S. Spencer	Supt. Conestogo Steam Mills	Lancaster, Pa.	Oct. 25, 1876.
George E. Spofford	Supt. Readville Cotton Mills	Readville, Mass.	Apr. 29, 1896.
Leroy Springs	Pres. Lancaster Cotton Mills	Lancaster, S. C.	Oct. 24, 1895.
George R. Stearns	Pres. Riverside Mills	Augusta, Ga.	Apr. 30, 1890.
Walter F. Stiles	Treas. Nockege & Orswell Mills	Fitchburg, Mass.	Oct. 24, 1895.
O. W. Stites		Hoosick Falls, N. Y.	Oct. 24, 1895.
Herman F. Straw	Agt. Amoskeag Manufg. Co.	Manchester, N. H.	Oct. 28, 1885.
Walter H. Summersby	Supt. Pontiac Mill and Bleachery	Pontiac, R. I.	Oct. 25, 1893.
Albert A. Sweet	Supt. King Philip Mills	969 Charles St., Fall River, Mass.	Apr. 26, 1893.
James O. Sweet	Agt. and Treas. Ashland Cotton Co.	Jewett City, Conn.	Apr. 28, 1886.
Edward P. Taft	Treas. Ponemah Mills	Box 1443, Providence, R. I.	Oct. 28, 1885.
Robert Rennie Taft	Supt. Baltic Power Co.	Baltic, Conn.	Apr. 24, 1895.
Robert W. Taft	Asst. Treas. Bernon Mills; Treas. Coventry Co.	Box 1144, Providence, R. I.	Sept. 27, 1894.
George P. Taylor		Clinton, Mass.	Oct. 27, 1880.
James W. Taylor	Supt. Canoe River Mills	Box 46, Taunton, Mass.	Oct. 26, 1892.
W. Marshall Taylor	Supt. Cotton Mill, The Wm. Clark Thread Co.	69 Mechanic St., Westerly, R. I.	Sept. 22, 1896.
Richard Thackeray	Supt. Weetamoe Mills	Fall River, Mass.	Apr. 29, 1885.
Earl A. Thissell	Amasa Pratt & Co.	Lowell, Mass.	Oct. 30, 1878.
Ariel C. Thomas	Supt. Clinton Manufg. Co.	93 Clinton St., Woonsocket, R. I.	Oct. 31, 1888.
Charles E. Thomas	Treas. Forestdale Manufg. Co.	Woonsocket, R. I.	Oct. 31, 1883.
Edward W. Thomas	Agt. Tremont and Suffolk Mills	Lowell, Mass.	Apr. 30, 1884.
Ralph E. Thomson	Supt. Parkhill Manufg. Co.	Fitchburg, Mass.	Apr. 25, 1894.
D. M. Thompson	Pres. & Treas. Corliss Steam Engine Co.	Providence, R. I.	Oct. 28, 1885.
James P. Tolman	Pres. Samson Cordage Works	115 Congress St., Boston, Mass.	Oct. 29, 1890.
D. A. Tompkins	Pres. Atherton Mills	Charlotte, N. C.	Oct. 24, 1895.
George W. Towne	Supt. Cotton Dept. Arlington Mills	Lawrence, Mass.	Oct. 26, 1892.
William E. Trainer	Pres. Linwood Mills	Trainer, Penn.	Apr. 21, 1875.
Robert B. Treat	Centerville Cotton Mills	Centerville, R. I.	Sept. 27, 1894.
C. H. Truesdell	Supt. Attawaugan Co.	Killingly, Conn.	Oct. 29, 1884.
Edmund E. Truesdell	Supt. China, Webster & Pembroke Mills	Suncook, N. H.	Apr. 26, 1876.
Oscar B. Truesdell	Agt. Fiskdale Mills	Fiskdale, Mass.	Oct. 15, 1873.
George F. Tryon	Supt. Conanicut Mills	Fall River, Mass.	Apr. 28, 1897.
George E. Tucker	Agt. Otis Co.	Ware, Mass.	Oct. 24, 1895.
Charles D. Turnbull	Treas. Wm. A. Slater Mills Corp.	The Ludlow, Boston Mass.	Oct. 27, 1897.
William D. Twiss	Supt. Everett Mills	Lawrence, Mass.	April 29, 1896.
Charles T. Upton	Supt. Lowell Hosiery Co.	Lowell, Mass.	Apr. 28, 1897.

George A. Vaughan	Supt. The Putnam Manufg. Co.	Putnam, Conn.	Sept. 22, 1896.
Frank P. Vogl	Agt. Monadnock Mills	Claremont, N. H.	Sept. 27, 1894.
Jude C. Wadleigh	Supt. Mass. Cotton Mills	Lowell, Mass.	Oct. 26, 1892.
Herbert E. Walmesley	Agt. Wamsutta Mills	New Bedford, Mass.	Oct. 29, 1890.
Frederick T. Walsh	Agt. Lowell Bleachery & Dye Works,	Lowell, Mass.	Apr. 28, 1897.
James A. Walsh	Agt. Lewiston Bleachery and Dye Works	Lewiston, Me.	Apr. 27, 1892.
Arthur W. Warren	Treas. W. Warren Thread Works	Westfield, Mass.	Apr. 29, 1896.
John Waterman	Treas. Warren Manufg. Co.	Warren, R. I.	Apr. 30, 1884.
Joseph W. Wattles	Manufacturers' Supplies	Canton Junction, Mass.	July 18, 1866.
T. B. Wattles	Mangr. Boscawen Mills	Penacook, N. H.	July 18, 1866.
George W. Weeks		Clinton, Mass.	Apr. 21, 1869.
W. B. Smith Whaley	Pres. Richland Cotton Mills Granly Cotton Mills, 1328 Main St.	Columbia, S. C.	Apr. 24, 1895.
H. D. Wheat	Treas. & Gen. Mgr. Gaffney Mfg. Co.,	Gaffney, S. C.	Apr. 24, 1895.
Channing Whitaker	Infringement and Patentability of Inventions		
	Lowell Machine Shop	Lowell, Mass.	Oct. 15, 1873.
A. Tenny White	Supt. Manville Co.	Manville, R. I.	Oct. 26, 1887.
Charles D. White	Agt. Uncasville Mfg. Co.	Uncasville, Conn.	Oct. 27, 1897.
Z. L. White	White Bros.	Winchendon Springs, Mass.	Apr. 28, 1897.
Arthur F. Whitin	Treas. Whitinsville Cotton Mills	Whitinsville, Mass.	Apr. 24, 1895.
Fred B. Whitin	Supt. Uxbridge Cotton Mills	No. Uxbridge, Mass.	Apr. 28, 1897.
Henry T. Whitin	Treas Paul Whitin Manufg. Co.	Northbridge, Mass.	Apr. 25, 1877.
Alfred N. Whiting	Sec'y and Treas. L. M. Harris Manufg. Co.	Oakdale, Mass.	Apr. 21, 1875.
William S. Whitney	Supt. Mech. Depts., Washington Mills Co.,	Lawrence, Mass.	Apr. 24, 1878.
William Whittam, Jr.	733 Pleasant St.,	Pawtucket, R. I.	Apr. 26, 1893.
George F. Whitten	Agt. Amory Mfg. Co.	Manchester, N. H.	Oct. 26, 1892.
Edward B. Wilbur	Supt. Newberry Cotton Mills	Newberry, S. C.	Oct. 30, 1889.
Henry M. Wilcox	Treas. John Rhodes Warp Co.	Millbury, Mass.	Apr. 24, 1889.
Eben C. Willey	Supt. B. B. & R. Knights Co.	Manchaug, Mass.	Apr. 29, 1896.
Theop. W. Wilmarth	Supt. Millbury Cotton Mills	Millbury, Mass.	Oct. 31, 1883.
Thomas Wilmarth	Supt. Saunders Cotton Mills	Saundersville, Mass.	Apr. 21, 1875.
J. P. Wilson	Treas. Dover Yarn Mills	Charlotte, S. C.	Oct. 24, 1895.
A. S. Winslow	Agt. Peabody Mills	Newburyport, Mass.	Oct. 31, 1888.
George Wood	Pres. and Treas. Millville Manufg. Co.		
	626 Chestnut St.,	Phila., Pa.	Oct. 16, 1872.
John P. Wood	William Wood & Co.		
	22d and Spring Garden Sts.,	Philadelphia, Pa.	Apr. 28, 1897.
C. J. H. Woodbury	Secretary and Treasurer	Lynn, Mass.	Oct. 29, 1879.
Alvin Woodman	32 Wilder St.	Brockton, Mass.	Apr. 26, 1893.
A. A. Young, Jr.	Treas. Jewett City Mills	Jewett City, Conn.	Sept. 27, 1894.
Adelbert R. Young	Supt. Ashland Cotton Co.	Jewett City, Conn.	Apr. 25, 1894.

ASSOCIATE MEMBERS.

Henry Ashworth	Agt. Card Clothing Manufg. Co.	Fall River, Mass.	Apr. 28, 1897.
George R. Babbitt	Pres. American Oil Co.	182 So. Water St., Providence, R. I.	Apr. 24, 1895.
D. C. Ball	The American Cotton Co.	109 Walnut St., St. Louis, Mo.	Oct. 24, 1895.
George S. Barnum	Secy. and Treas. The Bigelow Co.	New Haven, Conn.	Apr. 24, 1895.
Colin C. Bell	Pres. and Treas. Laminar Fibre Co.	No. Cambridge, Mass.	Apr. 29, 1896.
Frank P. Bennett	Publisher American Wool and Cotton Reporter	148 Pearl St., Boston, Mass.	Sept. 22, 1896.
George W. Benson	A. Emerson & Co., Cotton Waste	237 Congress St., Boston, Mass.	Apr. 24, 1895.
William H. Bent	Treas. Taunton Machine Works	Taunton, Mass.	Apr. 29, 1896.
J. Payson Bradley	The Kehew-Bradley Co.	24 Purchase St., Boston, Mass.	Apr. 24, 1895.
J. Frank Braids	Mgr. Grease & Oil Dept., Charles S. Bush Co.	212 Weybosset St., Providence, R. I.	Apr. 28, 1897.
Henry G. Brinckerhoff	N. E. Mgr. Fuel Economizer Co., Box 2654	Room 321, 53 State St., Boston, Mass.	Sept. 22, 1896.
D. Russell Brown	Pres. Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.
H. Martin Brown	Brown Bros. Co.	Providence, R. I.	Apr. 24, 1895.
John H. Burghardt	Page Belting Co.	31 Pearl St., Boston, Mass.	Apr. 24, 1895.
Eugene E. Burnham	Belt Mfr.	168 Broadway, Lawrence, Mass.	Oct. 24, 1895.
Harry W. Butterworth	Sec. H. W. Butterworth & Sons	2417 East York St., Philadelphia, Pa.	Oct. 27, 1897.
James Butterworth	Pres. H. W. Butterworth & Sons Co.	2417 East York St., Philadelphia, Pa.	Apr. 24, 1895.
French Campbell	Commission Merchant	Manchester, N. H.	Oct. 27, 1897.
Malcolm Campbell	Gen. Mgr. Woonsocket Machine and Press Co.	Woonsocket, R. I.	Apr. 24, 1895.
W. W. Carey	Wood Rim Pulley Manufacturer	Lowell, Mass.	Apr. 24, 1895.
Fred A. Chase	Mill Supplies, F. A. Chase & Co.	Providence, R. I.	Apr. 24, 1895.
Charles H. Child	Treas. Brown Bros. Co.	Box 890, Providence, R. I.	Apr. 24, 1895.
Peter H. Corr	Cotton and Cotton Yarns	Taunton, Mass.	Apr. 24, 1895.
Thomas G. Cox	Selling Agt. Mason Machine Works	Box 316, Taunton, Mass.	Apr. 24, 1895.
George Crompton	Treas. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 27, 1897.
Randolph Crompton	Asst. Treas. Crompton Knowles Loom Works	Worcester, Mass.	Oct. 27, 1897.
Frederick I. Dana	Mech. Eng. Thomas Phillips Co.	Providence, R. I.	Apr. 24, 1895.
J. F. Dickinson	Treas. South Belting Co.	Atlanta, Ga.	Apr. 29, 1896.
R. H. Deming	Cotton Broker	10 So. Water St., Providence, R. I.	Apr. 24, 1895.

C. E. W. Dow . . . . Mgr. American Bolt Co. . . . . Lowell, Mass. . . . Apr. 24, 1895.
Frederick A. Downes . Sec. Factory Mutual Fire Insurance Co. . . . . 925 Chestnut St., Philadelphia, Pa. . . Oct. 27, 1897.

G. B. Emmons . . . . Pres. Emmons Loom Harness Co. . . . . Box 94, Methuen Mass. . . . Oct. 24, 1895.
T. C. Entwistle . . . . Cotton Machinery Manufacturer . . Lowell, Mass. . . . . Apr. 24, 1895.

L. C. Farnsworth . . . Farnswarth Card Clothing Co. . . . Pittsfield, Mass. . . . Oct. 27, 1897.
D. D. Felton . . . . . Treas. S. A. Felton & Son Co. . . . Manchester, N. H. . Apr. 24, 1895.
John W. Ferguson . . General Contractor . . . . . Paterson, N. J. . . . Apr. 24, 1895.
J. Herbert Foster . . . Cotton Broker . . . . . Providence, R. I. . . . Apr. 24, 1895.
George A. Fuller . . . Mgr. Amer. Card Clothing Co. . . . Providence, R. I. . . . Apr. 24, 1895.
Merrill A. Furbush . . M. A. Furbush & Son Machine Co. . . . . 224 Market St., Philadelphia, Pa. . . Oct. 27, 1897.
John T. Fyans . . . . Agt. Fyans, Frazer & Blackway . . . . . 411 Black St., Fall River, Mass. . . Apr. 28, 1897.

H. P. Garland . . . . Treas. Loom Picker Co. . . . . Biddeford, Me. . . . Oct. 24, 1895.
Royal W. Gates . . . . Josiah Gates & Sons, Belting . . . . . 307 Market St., Lowell, Mass. . . . Apr. 24, 1895.
Rufus B. Goff . . . . Pres. Standard Mill Supply Co. . . . . 77 Exchange Pl., Box 714, Providence, R. I. . . Apr. 28, 1897.
William S. Granger . . Prest. Granger Foundry & Machine Co., Providence, R. I. . Apr. 24, 1895.
Henry T. Grant, Jr. . . Pres. Mercantile Mutual Fire Ins. Co., Providence, R. I. . . Oct. 27, 1897.

William L. Haines . . Agt. for Brooks & Doxey, of Manchester, Eng. . . . . 161 Pearl St., Boston, Mass. . . . Apr. 29, 1896.
A. Walter Harris . . . Treas. A. W. Harris Oil Co. . . . . 326 So. Water St., Providence, R. I. . . Oct. 24, 1895.
Alfred H. Hartley . . Dealer in Oils and Mill Supplies . . . . . Box 409, Fall River, Mass. . . Oct. 27, 1897.
John H. Haworth . . . Haworth & Watson Mfrs. Paper Tubes . . . . . for Textile Manufg. Columbus Av., Lowell, Mass. . . . Oct. 24, 1895.
Jerome Hill . . . . . Pres. Jerome Hill Cotton Co. . . . . 116 South Main St., St. Louis, Mo. . . . Apr. 29, 1896.
Henry A. Holcomb . . Treas. New Bedford Boiler and Machine Co. . . . . New Bedford, Mass. . Oct. 24, 1895.
Henry S. Houghton, Sr., Mfr. Grids and Beaters . . . . . 65 Pond St., Woonsocket, R. I. . Apr. 28, 1897.
Alfred A. Hunting . . Mechanical Engineer . . . . . 10-12 Federal St., Boston, Mass. . . . Oct. 27, 1897.
C. H. Hutchins . . . . Pres. Crompton & Knowles Loom Works . . . . . Worcester, Mass. . . Oct. 24, 1895.

David Jackson . . . . Pres. & Mgr. Jackson Patent Shell Roll Co., Pawtucket, R. I. Apr. 24, 1895.

William B. Kehew	The Kehew-Bradley Co.	24 Purchase St., Boston, Mass.	Apr. 24, 1895.
Josiah M. Lasell	Asst. Treas. Whitin Machine Works,	Whitinsville, Mass.	Apr. 24, 1895.
John H. Lorimer	Scouring, Dyeing and Drying Machinery	Ontario and Lawrence Sts., Philadelphia, Pa.	Oct. 27, 1897.
Stephen C. Lowe	Mill Supplies	87 Union St., New Bedford, Mass.	Oct. 24, 1895.
F. H. Maynard	Bus. Mgr. Gen. Fire Extinguisher Co.,	Providence, R. I.	Apr. 24, 1895.
H. G. McKerrow	Textile Machinery	31 State St., Boston, Mass.	Sept. 22, 1896.
George H. Meader	Steam Appliances	35 Oliver St., Boston, Mass.	Apr. 24, 1895.
George B. Morison	Selling Agt. Hadley Co.	95 Milk St., Boston, Mass.	Apr. 24, 1895.
William R. Noone	Mfr. Roller and Slasher Cloth	100 Pearl St., Boston, Mass.	Oct. 27, 1897.
Sidney B. Paine	General Electric Co.,	180 Summer St., Boston, Mass.	Apr. 24, 1895.
Arthur Parkinson	Selling Agt. Arabol Mfg. Co.,	13 Gold St., New York, N. Y.	Apr. 28, 1897.
Stephen Minot Pitman	Sec'y Narragansett Mutual Fire Insurance Co.	Box 315, Providence, R. I.	Apr. 24, 1895.
Vladimir P. Polevoy	Pur. Agt. Great Yaroslovskair Mfg. Co. (of Yaroslave), Russia	120 Broadway, N. Y.	Apr. 28, 1897.
Charles A. M. Praray	of C. R. Makepeace & Co., Mill Architect and Engineer	430 Butler Exchange, Providence, R. I.	Apr. 28, 1897.
Charles F. Randall	Expert in Textiles	Room 350, Tremont Building, Boston, Mass.	Apr. 24, 1895.
Richard H. Rice	Treas. Rice & Sargent Steam Engine Co.	40 Codding St., Providence, R. I.	Apr. 24, 1895.
C. E. Roberts	Mgr. Hartford Steam Boiler Insurance & Inspection Co.	125 Milk St., Boston, Mass.	Apr. 24, 1895.
Louis E. Robinson	Sea Island Cotton,	20 Market Square, Provtdence, R. I.	Oct. 27, 1897.
John M. Russell	Asst. Treas. Crompton & Knowles Loom Works	Worcester, Mass.	Oct. 24, 1895.
E. A. Smith	Pres. Charlotte Supply Co.	Charlotte, N. C.	Oct. 24, 1895.
Harry M. Smith	Vice-Pres. Standard Mill Supply Co.	77 Exchange Pl., Box 714, Providence, R. I.	Apr. 28, 1897.
R. Paul Snelling	Treas. Saco and Pettee Machine Shops	Newton Upper Falls, Mass.	Sept. 22, 1896.
Lewis R. Speare	Alden Speare Sons & Co., Oil and Mill Supplies	369 Atlantic Ave., Boston, Mass.	Oct. 24, 1895.
Henry C. Spence	Gen. Mgr. Metallic Drawing Roll Co.	Indian Orchard, Mass.	Apr. 24, 1895.
George W. Stafford	Mgr. Knowles Loom Works	Providence, R. I.	Apr. 24, 1895.
James Strang	Selling Agt. Met. Drawing Roll Co.	Indian Orchard, Mass.	Oct. 27, 1897.

William H. Stratton . . Asst. Mgr. Factory Insurance Asso. . . . . 95 Pearl St., Hartford, Conn. . . Apr. 28, 1897.
Daniel J. Sully . . . . Cotton Broker, T. M. Reynolds & Co., Providence, R. I. . . Apr. 24, 1895.

Cyrus A. Taft . . . . Agt. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.
Winthrop Thayer . . . Pres. Thayer Co., 1015 Tremont Bldg., Boston, Mass. . . Apr. 29, 1896.
A. Curtis Tingley . . . Treas. National Ring Traveler Co. . Providence, R. I. . . Sept. 22, 1896.
William V. Threlfall . . Selling Agt. Saco and Pettee Machine Shops . . . . . Newton Upper Falls, Mass. . Apr. 24, 1895.

Frank H. Underwood . Mgr. Dodge Mfg. Co., 137 Purchase St., Boston, Mass. . . Apr. 29, 1896.

Justin A. Ware . . . . Sales Mgr. Crompton & Knowles Loom Works . . . . . Worcester, Mass. . . Oct. 24, 1895.
Walter S. Watson . . . Haworth & Watson Mfrs. Paper Tubes . . . . . for Textile Manufg. . Box 996, Lowell, Mass. . . . Oct. 24, 1895.
William R. West . . . Roll Coverer . . 830 Purchase St., New Bedford, Mass. . Sept. 22, 1896.
G. Marston Whitin . . Treas. Whitin Machine Works . . . Whitinsville, Mass. . Apr. 24, 1895.
Fred A. Wilde . . . . Asst. Mgr. The A. T. Atherton Machine Co. . . . . Pawtucket, R. I. . . Apr. 28, 1897.

Erving Yale Woolley . Stoddard, Haserick, Richards & Co. . . . . 152 Congress St., Boston, Mass. . . Apr. 24, 1895.

Honorary Members	4
Active Members	427
Associate Members	92
Total Membership	523

MEMBERS OF THE ASSOCIATION,

November 1, 1897.

ARRANGED BY STATES.

MAINE.

Auburn	William Hayes	Barker Mill.
Biddeford	James G. Garland	
Biddeford	H. P. Garland	Loom Picker Co.
Biddeford	Robert McArthur	Pepperell & Laconia Cos.
Brunswick	Russell W. Eaton	Cabot Manufg. Co.
Kennebunk	Robert W. Lord	R. W. Lord & Co.
Lewiston	A. D. Barker	Avon Manufg. Co.
Lewiston	George W. Bean	Androscoggin Mills.
Lewiston	H. B. Estes	Continental Mills.
Lewiston	William D. Pennell	Hill Manufg. Co.
Lewiston	Herbert L. Pratt	Bates Manufg. Co.
Lewiston	Roscoe C. Reynolds	Lewiston Machine Co.
Lewiston	James A. Walsh	Lewiston Bleachery and Dye Works
Lisbon	W. H. Miles	Farwell Mills.
Old Orchard	John Gegenheimer	
Portland	James H. McMullan	Saco and Pettee Machine Shops.
Saco	Elmer E. Page	York Manufg. Co.
Westbrook	Woodbury K. Dana	Dana Warp Mills.

NEW HAMPSHIRE.

Charlestown	Samuel Webber	Hydraulic Engineer.
Claremont	Frank P. Vogl	Monadnock Mills.
Dover	John Drowne	Cocheco Manufg. Co.
Dover	Charles H. Fish	Cocheco Manufg. Co.
Dover	John Holland	12 Trackey St.
Exeter	Hervey Kent	Exeter Manufg. Co.

Greenville	Frederick W. Ely	Columbian Manufg. Co.
Manchester	Stephen N. Bourne	Stark Mills.
Manchester	French Campbell	Commission Merchant.
Manchester	George A. Clark	Manchester Mills.
Manchester	D. D. Felton	S. A. Felton & Sons Co.
Manchester	Elliott Cowdin Lambert	Amoskeag Manufg. Co.
Manchester	Charles H. Manning	Amoskeag Manufg. Co.
Manchester	Charles D. McDuffie	Manchester Mills.
Manchester	Eben H. Nutting	1029 Union St.
Manchester	Herman F. Straw	Amoskeag Manufg. Co.
Manchester	George F. Whitten	Amory Manufg. Co.
Milford	M. F. Foster	
Milford	Frank E. Kaley	Morse & Kaley Manufg. Co.
Nashua	William D. Cadwell	Nashua Manufg. Co. & Jackson Co.
Nashua	William T. Spear	Jackson Co.
Penacook	T. B. Wattles	Boscawen Mills.
Pittsfield	George E. Kent	Exeter Manufg. Co.
Salmon Falls	O. S. Brown	Salmon Falls Manufg. Co.
Somersworth	Charles H. Plummer	Great Falls Manufg. Co.
Suncook	David L. Jewell	China, Webster & Pembroke Mills.
Suncook	Edmund E. Truesdell	China, Webster & Pembroke Mills.

VERMONT.

North Pownall	Thomas Armstrong	North Pownal Manufg. Co.

MASSACHUSETTS.

Adams	John S. Adams, Jr.	Adams Bros. Manufg. Co.
Adams	Z. D. Hall	Berkshire Cotton Manufg. Co.
Adams	A. B. Mole	Greylock Mill.
Adams	Charles T. Plunkett	Berkshire Cotton Manufg. Co.
Adams	James Renfrew	Renfrew Manufg. Co.
Amesbury	M. W. Quinn	Hamilton Woolen Co.
Andover	John Bell	Smith & Dove Manufg. Co.
Belmont	John Kilburn	
Blackstone	Edward A. Mongeon	Blackstone Manufg. Co.
Bondsville	Elmer G. Childs	Boston Duck Co.
Bondsville	William E. Hall	Boston Duck Co.
Boston	Charles B. Amory	Hamilton Manufg. Co.
Boston	Edward Atkinson	Boston Mfrs. Mut. Fire Ins. Co.
Boston	Edward W. Atkinson	Stoddard, Haserick, Richards Co.
Boston	Joseph P. Battles	American Drosophore Co.
Boston	Frank P. Bennett	American Wool & Cotton Reporter.
Boston	George W. Benson	A. Emerson & Co.

Boston	J. Payson Bradley	The Kehew-Bradley Co.
Boston	Henry G. Brinckerhoff	Fuel Economizer Co.
Boston	John H. Burkhardt	Page Belting Co.
Boston	Alphonse S. Covel	Tremont & Suffolk Mills.
Boston	Ambrose Eastman	53 State St.
Boston	William Firth	American Drosophore Co.
Boston	Alfred M. Goodale	Boston Manufg. Co.
Boston	Stephen Greene	Mill Engineer and Architect.
Boston	William L. Haines	Brooks & Doxey, Manchester, Eng.
Boston	Henry S. Howe	Lawrence & Co.
Boston	Alfred A. Hunting	Mechanical Edgineer.
Boston	William B. Kehew	The Kehew-Bradley Co.
Boston	Evan Arthur Leigh	Textile Machinery.
Boston	Herbert Lyman	Hadley Co.
Boston	Charles T. Main	Mech. Mill Engineer.
Boston	Fred C. McDuffie	Everett Mills & York Manufg. Co.
Boston	H. G. McKerrow	Textile Machinery.
Boston	George H. Meader	Steam Appliances.
Boston	George B. Morison	Hadley Co.
Boston	William R. Noone	Roller and Slasher Cloth.
Boston	Sidney B. Paine	General Electric Co.
Boston	Francis J. Parker	Monadnock Mills.
Boston	Charles F. Randall	Expert in Textiles.
Boston	Charles E. Riley	Textile Machinery.
Boston	C. E. Roberts	Hartford St. Boiler Ins. & Insp. Co
Boston	Henry B. Sawyer	Newmarket Manufg. Co.
Boston	J. H. Sawyer	Newmarket Manufg. Co.
Boston	George H. Shapley	Silver Lake Co.
Boston	Willis S. Shepard	American Net & Twine Co.
Boston	Lewis R. Speare	Alden Speare Sons & Co.
Boston	Winthrop Thayer	Thayer Co.
Boston	James P. Tolman	Samson Cordage Works.
Boston	Charles D. Turnbull	William A. Slater Mills Corp.
Boston	Frank H. Underwood	Dodge Manufg. Co.
Boston	Erving Yale Woolley	Stoddard, Haserick, Richards Co.
Brockton	Alvin Woodman	32 Wilder St.
Canton Junction	Joseph W. Wattles	Manufacturers' Supplies.
Chicopee Falls	Henry A. Bailey	Chicopee Manufg. Co.
Clinton	William G. Nichols	Lancaster Mills.
Clinton	Charles H. Richardson	Lancaster Mills.
Clinton	George P. Taylor	
Clinton	George W. Weeks	
Easthampton	William O. Smith	Easthampton Spinning Co.
Fall River	F. S. Akin	Cornell Mills.
Fall River	Henry Ashworth	Card Clothing Manufr.
Fall River	John P. Bodge	Arkwright Mills.

Fall River	Nathaniel B. Borden	Barnard Manufg. Co.
Fall River	Richard B. Borden	Troy C. & W. Manufg. Co.
Fall River	Thomas J. Borden	Richard Borden Manufg. Co.
Fall River	George A. Chace	Bourne Mills.
Fall River	Simeon B. Chase	King Phillip Mills.
Fall River	John A. Collins	American Linen Co.
Fall River	B. D. Davol	Barnard Manufg. Co.
Fall River	David H. Dyer	Mill Engineer.
Fall River	William Evans	Richard Borden Manufg. Co.
Fall River	John T. Fyans	Fyans, Frazer & Blackway.
Fall River	Daniel Gilligan	Pocasset & Metacomet Mills.
Fall River	John Gregson	Merchants Mfg. Co.
Fall River	A. M. Hamilton	Parker Mills.
Fall River	John F. Hamlet	P. O. Box 160.
Fall River	Alfred H. Hartley	Oils and Mill Supplies.
Fall River	Samuel E. Hathaway	Fall River Iron Works Co.
Fall River	William Hathaway	Barnard Mfg. Co.
Fall River	William B. Hawes	North Dighton Cotton Co.
Fall River	George H. Hills	Davol Mills and Stephens Mfg. Co.
Fall River	Thomas Horsfield	Hargrave's Mills.
Fall River	Benjamin B. Kirk	Shove Mills.
Fall River	Leontine Lincoln	Seaconnet Mills.
Fall River	John R. Mason	Laurel Lake Mills.
Fall River	Philip A. Mathewson	King Philip Mills.
Fall River	William G. McLoon	Barnaby Manufg. Co.
Fall River	J. Edward Osborne	American Linen Co.
Fall River	Arnold B. Sanford	Sanford Spinning Co.
Fall River	Charles M. Shove	Granite Mills.
Fall River	Abbott E. Slade	Laurel Lake Mills.
Fall River	John Smith	Chace Mills.
Fall River	Albert A. Sweet	King Philip Mills.
Fall River	Richard Thackeray	Weetamoe Mills.
Fall River	George F. Tryon	Conanicut Mills.
Fiskdale	Oscar B. Truesdell	Fiskdale Mills.
Fitchburg	George P. Grant, Jr.	Grant Yarn Co.
Fitchburg	W. E. Keach	Grant Yarn Co.
Fitchburg	Arthur H. Lowe	Parkhill Manufg Co.
Fitchburg	David Lowe	Parkhill Manufg. Co.
Fitchburg	Warren M. Orswell	Orswell and Nockege Mills.
Fitchburg	Thomas C. Sheldon	Fitchburg Duck Mills.
Fitchburg	Walter F. Stiles	Nockege & Orswell Mills.
Fitchburg	Ralph E. Thomspon	Parkhill Manufg. Co.
Great Barrington	Jno. H. C. Church	Monument Mills.
Griswoldville	James C. Deane	Griswoldville Manufg. Co.
Holyoke	Jones S. Davis	397 Maple Street.
Holyoke	John W. Dickinson	Lyman Mills.
Holyoke	Joseph M. Dunham	Merrick Thread Co.

Holyoke	Ernest Lovering	Lyman Mills.
Holyoke	C. W. Rider	Merrick Thread Co.
Hopedale	Eben S. Draper	Draper Co.
Hopedale	George A. Draper	Draper Co.
Hopedale	George Otis Draper	Draper Co.
Hopedale	William F. Draper	Draper Co.
Hopedale	William F. Draper, Jr.	Draper Co.
Housatonic	T. G. Ramsdell	Monument Mills.
Indian Orchard	William C. Godfrey	Indian Orchard Co.
Indian Orchard	Charles J. Goodwin	Indian Orchard Co.
Indian Orchard	Henry C. Spence	Metallic Drawing Roll Co.
Indian Orchard	James Strang	Metallic Drawing Roll Co.
Lawrence	William A. Barrell	Lawrence Duck Co.
Lawrence	Eugene E. Burnham	Leather Belt Man'fr.
Lawrence	Frederick E. Clarke	Pemberton Co. and Methuen Co.
Lawrence	James I. Milliken	Everett Mills.
Lawrence	Roscoe S. Milliken	Pemberton Co.
Lawrence	Walter E. Parker	Pacific Mills.
Lawrence	Robert Redford	Arlington Mills.
Lawrence	William F. Sherman	Atlantic Cotton Mills.
Lawrence	Francis H. Silsbee	Pacific Mills.
Lawrence	George W. Towne	Arlington Mills.
Lawrence	William D. Twiss	Everett Mills.
Lawrence	William S. Whitney	Washington Mills Co.
Leicester	Charles A. Denny	American Card Clothing Co.
Lowell	George E. Ames	Lawrence Manufg. Co.
Lowell	Frank A. Bowen	Appleton Co.
Lowell	Christopher P. Brooks	Lowell Textile School.
Lowell	Edward N. Burke	Lowell Machine Shop.
Lowell	W. W. Carey	Wood Rim Pulley Manufacturer.
Lowell	Clarence N. Childs	Hamilton Manufg. Co.
Lowell	Jeremiah Clark	Textile Machinery.
Lowell	Alfred Clarke	Eastern Elec. Light & Stor. Bat. Co
Lowell	Alonzo A. Coburn	Atherton Machine Co.
Lowell	A. G. Cumnock	Boott Cotton Mills.
Lowell	Albert W. Danforth	881 Bridge St.
Lowell	Edward P. Dennis	Lowell Machine Shop.
Lowell	C. E. W. Dow	American Bolt Co.
Lowell	William A. Eastman	Lowell Hosiery Co.
Lowell	T. C. Entwistle	Manfr. Cotton Machinery.
Lowell	Frederick A. Flather	Lowell Machine Shop.
Lowell	Royal W. Gates	Josiah Gates & Sons.
Lowell	John J. Hart	Merrimac Print Works.
Lowell	John H. Haworth	Haworth & Watson Manufg. Co.
Lowell	James G. Hill	
Lowell	George L. Hooper	Shaw Stocking Co.
Lowell	Alvin S. Lyon	Lowell Manufg. Co.

Lowell	Albert H. Morton	Kitson Machine Co.
Lowell	Oliver H. Moulton	Hamilton Manufg. Co.
Lowell	Franklin Nourse	Lawrence Manufg. Co.
Lowell	John W. Pead	Merrimac Manufg. Co.
Lowell	Haven C. Perham	Kitson Machine Co.
Lowell	M. A. Rawlinson	Tremont & Suffolk Mills.
Lowell	William S. Southworth	Mass. Cotton Mills.
Lowell	Earl A. Thissell	Amasa Pratt & Co.
Lowell	Edward W. Thomas	Tremont and Suffolk Mills.
Lowell	Charles T. Upton	Lowell Hosiery Co.
Lowell	Jude C. Wadleigh	Mass. Cotton Mills.
Lowell	Frederick T. Walsh	Lowell Bleachery & Dye Works.
Lowell	Walter S. Watson	Haworth & Watson Manufg. Co.
Lowell	Channing Whitaker	Lowell Machine Shop.
Lynn	C. J. H. Woodbury	Secy. and Treas.
Manchaug	Eben C. Willey	B. B. & R. Knight Co.
Methuen	Lewis E. Barnes	Methuen Co.
Methuen	G. B. Emmons	Emmons Loom Harness Co.
Millbury	Fred W. Moore	Cordis Mills.
Millbury	Henry M. Wilcox	John Rhodes Warp Co.
Millbury	Theop. W. Wilmarth	Millbury Cotton Mills.
New Bedford	George A. Ayer	City Manufg. Corp.
New Bedford	Robert Burgess	Pierce Manufg. Corp.
New Bedford	Byron F. Card	Howland Mills.
New Bedford	P. Y. DeNormandie	Potomska Mills.
New Bedford	Frederick Grinnell	Gen. Fire Ex. Co.
New Bedford	Henry A. Holcomb	New Bedford Boiler and Mach. Co.
New Bedford	Nathaniel B. Kerr	Grinnell Manufg. Corp.
New Bedford	Walter H. Langshaw	Dartmouth Manufg. Corp.
New Bedford	George H. Law	Bristol Manufg. Corp.
New Bedford	Stephen C. Lowe	Mill Supplies.
New Bedford	Andrew G. Pierce, Jr.	Pierce Manufg. Corp.
New Bedford	Herbert E. Walmesley	Wamsutta Mills.
New Bedford	William R. West	Roll Coverer.
Newburyport	A. S. Winslow	Peabody Mills.
Newton	Josiah G. Coburn	
Newton Upper Falls	Frank J. Hale	Saco and Pettee Machine Shops.
Newton Upper Falls	R. P. Snelling	Saco and Pettee Machine Shops.
Newton Upper Falls	William B. Threlfall	Saco and Pettee Machine Shops.
North Adams	Charles W. Dennett	Johnson Manufg. Co. and Dunbar Mills Co.
Northbridge	Henry S. Houghton, Jr.	Paul Whitin Manufg. Co.
Northbridge	Henry T. Whitin	Paul Whitin Manufg. Co.
North Cambridge	Colin C. Bell	Laminar Fibre Co.
North Oxford	Edwin N. Bartlett	Sigourney and Rockdale Mills.
North Plymouth	Gideon F. Holmes	Plymouth Cordage Co.
North Uxbridge	Fred B. Whitin	Uxbridge Cotton Mills.

Oakdale	William B. Fitz	W. Boylston Manufg. Co.
Oakdale	Alfred N. Whiting	L. M. Harris Manufg. Co.
Pittsfield	L. C. Farnsworth	Farnsworth Card Clothing Co.
Reedville	George E. Spofford	Reedville Cotton Mills.
Salem	William P. McMullen	Naumkeag Steam Cotton Co.
Saundersville	Thomas Wilmarth	Saunders Cotton Mills.
Shattuckville	Frank S. Field	Massaemit Yarn Mills.
Smithville	George W. Robbins	Barry Cotton Mill.
South Hadley Falls	William R. Hill	Glasgow Manufg. Co.
Taunton	A. C. Bent	Safety Seamless Pocket Co.
Taunton	William H. Bent	Taunton Machine Works.
Taunton	John J. Connell	Cohannet Mills.
Taunton	Peter H. Corr	Cotton & Cotton Yarns.
Taunton	Thomas G. Cox	Mason Machine Works.
Taunton	P. T. Creed	Hopewell Mills.
Taunton	H. H. Culver	Elizabeth Poole Mill.
Taunton	Henry S. Culver	Westville Cotton Mill.
Taunton	Herbert Fisher	
Taunton	Abbott F. Lawrence	Nemasket Mills.
Taunton	Henry M. Lovering	Whittenton Manufg. Co.
Taunton	William M. Lovering	Whittenton Manufg. Co.
Taunton	Charles L. Macomber	Nemasket Mills.
Taunton	John Tempest Meats	Mason Machine Works.
Taunton	Herbert H. Shumway	Corr Manufg. Co.
Taunton	James W. Taylor	Canoe River Mills.
Thorndike	Charles H. Hobbs	Thorndike Co.
Three Rivers	Roscius C. Newell	Palmer Mills.
Turners Falls	Samuel L. Parker	Turners Falls Cotton Mills.
Waltham	Charles L. Bailey	Boston Manufg. Co.
Waltham	Charles E. Getchell	Waltham Bleachery and Dye Works.
Ware	George E. Tucker	The Otis Co.
Webster	Henry C. Phillips	H. N. Slater Mills.
West Boylston	F. H. Rice	Holbrook Mills.
West Fitchburg	John Leiper	Fitchburg Manufg. Co.
Westfield	Arthur W. Warren	W. Warren Thread Works.
West Warren	James W. Brown	Warren Cotton Mills.
Whitinsville	Alfred E. Adams	Linwood Mills.
Whitinsville	Josiah M. Lasell	The Whitin Machine Works.
Whitinsville	Oscar L. Owen	Whitin Machine Works.
Whitinsville	Arba C. Slater	Linwood Mills.
Whitinsville	Cyrus A. Taft	Whitin Machine Works.
Whitinsville	Arthur F. Whitin	Whitinsville Cotton Mills.
Whitinsville	G. Marston Whitin	The Whitinsville Machine Works.
Wilkinsonville	Ernest E. Clark	Sutton Manufg. Co.
Williamstown Sta.	Roland R. Kelly	Williamstown Manufg. Co.
Winchendon Springs	Z. L. White	White Bros.
Worcester	George Crompton	Crompton & Knowles Loom Works.
Worcester	Randolph Crompton	Crompton & Knowles Loom Works.

Worcester	Henry F. Harris	W. Boylston Manufg. Co.
Worcester	C. H. Hutchins	Crompton & Knowles Loom Works.
Worcester	John M. Russell	Crompton & Knowles Loom Works.
Worcester	Justin A. Ware	Crompton & Knowles Loom Works.

RHODE ISLAND.

Albion	Andrew J. Currier	Albion & Valley Falls Co.
Allenton	R. A. Gray	Rodman Manufg. Co.
Ashton	Arthur H. Gulliver	Lonsdale Co.
Central Falls	Stephen L. Adams	Stafford Manufg. Co.
Central Falls	Frank A. Jenks	U. S. Cotton Co.
Central Falls	O. B. Parker	U. S. Cotton Co.
Centreville	Harold Lawton	Warwick Mills.
Centreville	Robert B. Treat	Centreville Cotton Mills.
Crompton	C. T. Richmond	Crompton Co.
Crompton	Charles D. Robinson	Crompton Co.
Davisville	Walter B. Knight	Reynolds Manufg. Co.
Georgiaville	Herbert R. Farnum	Bernon Mills.
Greenville	Reuben Pilling, Jr.	The Granite Mills Co.
Hamilton	Joseph Warren Greene	Hamilton Web Co.
Manville	Charles Henry Savage	Manville Co.
Manville	A. Tenny White	Manville Co.
Pawtucket	Abel T. Atherton	A. T. Atherton Machine Co.
Pawtucket	William W. Blades	Lorraine Manufg. Co.
Pawtucket	William P. Dempsey	Dempsey Bleachery & Dye Works.
Pawtucket	David Jackson	Jackson Pat. Shell Roll Co.
Pawtucket	J. E. Jenckes	The E. Jenckes Manufg. Co.
Pawtucket	B. F. G. Linnell	Greene & Daniels Manufg. Co.
Pawtucket	Ira J. Martin	Bozrahville Co.
Pawtucket	James R. MacColl	Lorraine Manufg. Co.
Pawtucket	F. C. Sayles	Ponemah Mills.
Pawtucket	William Whittam, Jr.	733 Pleasant St.
Pawtucket	Fred A. Wilde	A. T. Atherton Machine Co.
Peace Dale	William C. Greene	Peace Dale Manufg. Co.
Phenix	Henry R. Brown	Hope Co. and Phenix Mill.
Phenix	Jesse A. Knight	Harris Manufg. Co.
Pontiac	W. H. Summersby	Pontiac Mill and Bleachery.
Providence	Charles T. Aldrich	Aldrich Manufg. Co.
Providence	William Ames	Fletcher Manufg. Co.
Providence	H. C. Atwood	Williamsville Manufg. Co.
Providence	George R. Babbitt	American Oil Co.
Providence	Truman Beckwith	Dyerville Manufg. Co.
Providence	J. Frank Braids	Chas. S. Bush Co.
Providence	D. Russell Brown	Brown Bros. Co.
Providence	H. Martin Brown	Brown Bros. Co.

Providence	E. C. Bucklin	Harris Manufg. Co. and Interlaken Mills.
Providence	Fred A. Chase	F. A. Chase & Co.
Providence	Charles H. Child	Brown Bros. Co.
Providence	Frank B. Comins	U. S. Aerphor Co.
Providence	Frederick I. Dana	Thomas Phillips Co.
Providence	A. Lockwood Danielson	Quinebaug Co.
Providence	J. DeForest Danielson	Lockwood Co.
Providence	John W. Danielson	Lockwood Co.
Providence	R. H. Deming	Cotton Broker.
Providence	J. Herbert Foster	Cotton Broker.
Providence	George A. Fuller	American Card Clothing Co.
Providence	William Gammell	Berkeley Co.
Providence	Rufus B. Goff	Standard Mill Supply Co.
Providence	William B. Gowdey	Mill Supplies.
Providence	William S. Granger	Granger Foundry & Machine Co.
Providence	Henry T. Grant, Jr.	Mercantile Mutual Fire Ins. Co.
Providence	John H. Hambley	Quidnick Manufg. Co.
Providence	A. Walter Harris	A. W. Harris Oil Co.
Providence	Elisha H. Howard	Harris Manufg. Co.
Providence	Joseph H. Kendrick	American Supply Co.
Providence	John M. Kimball	Slatersville Mills.
Providence	Stephen A. Knight	Hebron Manufg. Co.
Providence	Charles W. Lippitt	Silver Spring B. & D. Co.
Providence	Henry F. Lippitt	Social and Manville Cos.
Providence	Charles R. Makepeace	Mill Engineer.
Providence	F. H. Maynard	Gen. Fire Extinguisher Co.
Providence	Thomas Mayor	Thomas Mayor & Son.
Providence	William C. Peirce	Elizabeth Mills.
Providence	Stephen Minot Pitman	Narragansett Mutual Fire Ins. Co.
Providence	Thomas C. Powell	Banigan Building.
Providence	Charles A. M. Praray	C. R. Makepeace & Co.
Providence	Richard H. Rice	Rice & Sargent, Steam Engine Co.
Providence	Louis E. Robinson	Sea Island Cotton.
Providence	Frank P. Sheldon	Mill Engineer.
Providence	Harry M. Smith	Standard Mills Supply Co.
Providence	George W. Stafford	Knowles Loom Works.
Providence	Daniel J. Sully	T. M. Reynolds & Co.
Providence	Edward P. Taft	Ponemah Mills.
Providence	Robert W. Taft	Coventry Co. and Bernon Mills.
Providence	D. M. Thompson	Corliss Steam Engine Co.
Providence	A. Curtis Tingley	Nat. Ring Traveler Co.
Quidnick	Albert Knight	Quidnick Mills.
Quidnick	Albert F. Knight	
Riverpoint	Arthur F. Brackett	Riverpoint and Arctic Mills.
Slatersville	William P. Holt	The Wm. A. Slater Mills Corp.
Slatersville	Harry W. Kimball	The Wm. A. Slater Mills Corp.

Valley Falls	Arnold B. Chace, Jr.	Woonsocket Mills.
Warren	Arnold Schaer	Warren Manufg. Co.
Warren	John Waterman	Warren Manufg. Co.
Westerly	Louis L. Hohn	Wm. Clark Thread Co.
Westerly	W. Marshall Taylor	Wm. Clark Thread Co.
Woonsocket	Malcolm Campbell	Woonsocket Mach. & Press Co.
Woonsocket	Charles H. Gorton	J. P. & E. K. Ray.
Woonsocket	Frank Harris	Hamlet Mills.
Woonsocket	Henry S. Houghton, Sr.	Grids and Beaters.
Woonsocket	Charles H. Merriman, Jr.	Social and Nourse Mills.
Woonsocket	William A. Robinson	Social Manufg. Co.
Woonsocket	Ariel C. Thomas	Clinton Manufg. Co.
Woonsocket	Charles E. Thomas	Forestdale Manufg. Co.

CONNECTICUT.

Baltic	Robert Rennie Taft	Baltic Power Co.
Hartford	William H. Stratton	Factory Ins. Asso.
Jewett City	Charles F. Farrar	The Wm. A. Slater Mills Corp.
Jewett City	J. Colby Lewis	The Wm. A. Slater Mills Corp.
Jewett City	A. P. Malcolmson	The Wm. A. Slater Mills Corp.
Jewett City	James O. Sweet	Ashland Cotton Co.
Jewett City	A. A. Young, Jr.	Jewett City Mills.
Jewett City	Adelbert R. Young	Ashland Cotton Co.
Killingly	W. E. Atwood	Williamsville Manufg. Co.
Killingly	C. H. Truesdell	Attawaugan Co.
New Hartford	Robert R. Smith	Greenwoods Co.
New Haven	George S. Barnum	The Bigelow Co.
No. Grosvenor Dale	Frank M. Messenger	Grosvenor Dale Co.
Norwich	W. N. Blackstone	Attawaugan Co.
Norwich	W. R. Burnham	Uncasville Manufg. Co.
Norwich	C. H. Frisbie	Attawaugan Co.
Norwich	Marcellus Gould	Falls Co.
Norwich	W. G. Henderson	Shetucket Co.
Norwich	Moses Pierce	Aspinook Co.
Putnam	George W. Holt	Monohansett Manufg. Co.
Putnam	George A. Vaughan	Putnam Manufg. Co.
Taftville	Joseph D. Aiken	Ponemah Mills.
Taftville	John Eccles	Ponemah Mills.
Uncasville	Charles D. White	Uncasville Manufg. Co.
Wauregan	James A. Atwood	Wauregan Mills.
Wauregan	John Walter Atwood	Wauregan Mills.
Willimantic	E. S. Boss	Willimantic Linen Co.
Willimantic	John Scott	Willimantic Linen Co.

NEW YORK.

Capron	W. H. Cloher, Jr.	Utica Cotton Co.
Cohoes	David S. Johnston	Cohoes Iron Foundry & Machine Co.
Cohoes	John E. Prest	Harmony Mills.
Hoosick Falls	O. W. Stites	
New York City	George Arms	Grand Hotel.
New York City	Edwin H. Baker	Bliss, Fabyan & Co.
New York City	Edward R. Ballou	Brighton Mills.
New York City	Arthur B. Mann	J. H. Martin & Co.
New York City	Dudley T. Lyall	Brighton Mills.
New York City	William L. Lyall	J. & W. Lyall Loom & Mach. Works.
New York City	Arthur Parkinson	Arabol Manufg. Co.
New York City	Duncan D. Parmly	Johnson Mfg. Co.
New York City	Vladimir P. Polevoy	Yaroslovskair Manufg. Co.
New York Mills, Oneida Co., John P. Campbell, New York Mills.		
Oswego	George H. Sayward	Standard Yarn Co.
Utica	George DeForest	Utica Steam Cotton Mills and Mohawk Valley Mills.
Utica	D. W. Gray	Skenandoa Cotton Co.
Utica	Henry F. Mansfield	Utica Steam Cotton Mills.
Victory Mills	Joseph O. Hannum	Saratoga Victory Manufg. Co.

NEW JERSEY.

Garwood	William B. Munroe	
Gloucester City	Philip H. Fowler	
Jersey City	Ernest Bridge	Jas. Chadwick & Bro. Ltd.
Millville	John K. Russell	May's Landing Water Power Co.
Newark	William H. Loftus	Clark Thread Co.
Paterson	John W. Ferguson	General Contractor.

PENNSYLVANIA.

Chester	D. Edwin Irving	The Irving & Leiper Manufg. Co.
Chester	William Galey	Aberfoyle Manufg. Co.
Lancaster	S. S. Spencer	Conestoga Steam Mills.
Mt. Joy	Thomas J. Brown	George Brown's Sons.
Philadelphia	Robert Beatty	Robert Beatty & Co.
Philadelphia	T. Ashby Blythe	Ashby Cotton Mills.
Philadelphia	Harry W. Butterworth	H. W. Butterworth & Sons.
Philadelphia	James Butterworth	H. W. Butterworth & Sons.
Philadelphia	Frederick A. Downes	Factory Mutual Fire Ins. Co.
Philadelphia	Edward W. France	Phila. Textile Schools.
Philadelphia	Merrill A. Furbush	M. A. Furbush & Son Mach. Co.
Philadelphia	Joshua Garsed	Garsed & Co., Wingohocking Mills, Frankford.

Philadelphia	W. C. Houston, Jr.	Hope Mills Manufg. Co.
Philadelphia	John H. Lorimer	Scouring, Dyeing and Drying Mach.
Philadelphia	David Milne	C. J. Milne & Sons.
Philadelphia	George Wood	Millville Manufg. Co.
Philadelphia	John P. Wood	William Wood & Co.
Trainer	William E. Trainer	Linwood Mills.

DELAWARE.

Wilmington	William P. Bancroft	Joseph Bancroft & Sons Co.

MARYLAND.

Baltimore	James A. Gary	Gary Manufg. Co.

NORTH CAROLINA.

Charlotte	H. S. Chadwick	Dover Yarn Mill and Dilling Cotton Mills.
Charlotte	E. A. Smith	Charlotte Supply Co.
Charlotte	D. A. Tompkins	Atherton Mills.
Henrietta	Fred S. Mosher	Henrietta Mills.
Kings Mountain	Philip S. Baker	Crowders Mt. Cotton Mills.
Kings Mountain	F. Dilling	Dilling Cotton Mills.
Kings Mountain	C. E. Falls	Enterprise Mills.
Mountain Island	W. T. Jordan	Mt. Island Manufg. Co.
Reidsville	John W. Arrington	Edna Cotton Mills.

SOUTH CAROLINA.

Charleston	Horace L. Hayden	Charleston Mills.
Charlotte	J. P. Wilson	Dover Yarn Mills.
Columbia	Charles K. Oliver	Columbia Mills Co.
Columbia	W. B. Smith-Whaley	Richland Cotton Mills.
Gaffney	H. D. Wheat	Gaffney Manufg. Co.
Lancaster	Leroy Springs	Lancaster Cotton Mills.
Langley	Arthur T. Smith	Langley Manufg. Co.
Newberry	Edward B. Wilbur	Newberry Cotton Mills.
Pelzer	B. F. Guy	Pelzer Manufg. Co.
Pelzer	Ellison A. Smyth	Pelzer Manufg. Co.

GEORGIA.

Atlanta	J. F. Dickinson	So. Belting Co.
Atlanta	Oscar Elsas	Fulton Bag and Cotton Mills.
Atlanta	Henry E. Fisher	Atlanta Cotton Mills.

Atlanta	James R. Pearce	Fulton Bag and Cotton Mills.
Augusta	Otis G. Lynch	Enterprise Manufg. Co.
Augusta	Joel Smith	J. P. King Mfg. Co.
Augusta	George R. Stearns	Riverside Mills.
Columbus	E. N. Clemence	Eagle & Phenix Manufg. Co.
Griffin	Albert G. Martin	Kincaid Manufg. Co.
LaGrange,	Samuel Hale	Dixie Cotton Mills.
Lindale, Floyd Co.	Arthur W. Hunking	Mass. Mills in Georgia.
Macon	W. H. Richmond	Bibb Mill No. 2.

TENNESSEE.

Knoxville	William T. Lang	Brookside Mills.
Nashville	T. B. Dallas	Phenix Cotton Mills, Dallas Mfg. Co.

MISSOURI.

St. Louis	D. C. Ball	American Cotton Co.
St. Louis	Jerome Hill	Jerome Hill Cotton Co.

LOUISIANA.

New Orleans	S. Odenheimer	Lane Mills.

KENTUCKY.

Henderson	Paul J. Marrs	Henderson Cotton Mills.

ALABAMA.

Cordova	Albert W. Dimick	Indian Head Mills.
Huntsville	T. W. Pratt	West Huntsville Cotton Mills.

TEXAS.

Dickinson	Lawrence V. Elder	
Galveston	D. M. Ehrlich	Galveston Cotton Mills.
Waco	Jno. Hopkinson	Slayden & Kirksey Woolen Mills.

CANADA.

Hamilton, Ont.	Charles Owen Dexter	Canadian Colored Cotton Mills Ltd.
Hamilton, Ont.	Farquharson J. Muir	Canadian Colored Cotton Mills Ltd.
Montreal, P. Q.	Alfred Hawkesworth	Merchants Cotton Co.
Montreal, P. Q.	Fred Hawkesworth	Merchants Cotton Co.

Montreal, P. Q.	W. S. Hume	Dominion Cotton Mills Co. Ltd.
Montreal, P. Q.	Henry D. Martin	Dominion Cotton Mills Co. Ltd.
Valleyfield, P. Q.	Fred Lacey	Montreal Cotton Co.
Valleyfield, P. Q.	Louis Simpson	Montreal Cotton Co.

NEW BRUNSWICK.

Marysville	John B. Cudlip	Gibson Cotton Mills.
St. John	John H. Parks	Wm. Parks & Sons, Ltd.

RECAPITULATION.

LOCATION OF MEMBERSHIP.

Maine	18
New Hampshire	27
Vermont	1
Massachusetts	255
Rhode Island	98
Connecticut	28
New York	19
New Jersey	6
Pennsylvania	18
Delaware	1
Maryland	1
North Carolina	9
South Carolina	10
Georgia	12
Kentucky	1
Tennessee	2
Missouri	2
Louisiana	1
Texas	3
Alabama	2
Canada	8
New Brunswick	2
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IN MEMORIAM.

RICHARD GARSED.

RICHARD GARSED died at his home in Frankford, Philadelphia, on July 27, 1897. He was born at Swift Place Mills, Yorkshire, England, September 15, 1819, and came to this country in his infancy with his parents. His father became one of the pioneers of the cotton industry in Pennsylvania, and at the age of eight, Richard began work in the mill, and in 1840 succeeded to his father's business. Three years later he removed to Frankford and in company with his brother John operated the Middlesex Mill, and in 1853 built the Wingohocking Mills, with which he was connected up to the time of his death.

He was progressive in the enlargement of the lines of manufacturing and was thoroughly acquainted with the cotton manufacturing business in which he had made a number of inventions, particularly in connection with improvements upon the loom which were in the line of simplicity of construction and greater speed in operation.

He was also one of the pioneers in the reduction of the weight of spindles for frame spinning.

He showed his keen interest in this Association by the active part he had taken in its meetings. He became a member April 17, 1872, and was a Director 1881, Vice President 1881–85 and President 1885–6.

CHARLES C. DIMAN.

CHARLES C. DIMAN died November 7, 1897, at the age of forty-seven years. He was a native of Fall River, and early in life entered the American Linen Mill of that place, and later was in the employment of the Lonsdale Company. Returning to Fall River he was made the overseer of ring spinning in the Sagamore Mill, where he learned the foundation principles of the manufacturing business with which he was afterwards to be so intimately acquainted. From this place he became superintendent of the Durfee Mill No. 2, and was afterwards connected in a similar capacity with No. 3 Mill. At the opening of the Cornell Mill he was its superintendent, and some time later he went to New Bedford to take charge of the Bristol Mill. Mr. DIMAN became interested in the project of building the Whitman Mills and since the establishment of these mills had been connected with the concern as treasurer and agent, respectively. He was President of the New Bedford Textile School Corporation, which place he had recently resigned. Mr. DIMAN was an enterprising mill manager, and to his untiring activity and the originality of his ideas was largely due the success of the various manufactories with which he was connected.

Mr. DIMAN became a member of the New England Cotton Manufacturers' Association April 24, 1895, and has been in constant attendance at the meetings.

THE LADY GUESTS.*

Any report of the meeting of this Association at Philadelphia would be quite inadequate without honorable mention of the courteous and gracious attention and entertainment given by the ladies of Philadelphia to the lady guests of the Association.

Nothing could have exceeded their hospitality. Did a guest desire information upon any subject, immediately a lady, who appeared to have been anticipating that very want, was at her side, ready not only to instruct but to serve as escort.

An associate committee of thirty-four women with Mrs. E. D. GILLESPIE, a grandaughter of BENJAMIN FRANKLIN, as chairman, had been appointed in addition to one of twenty-seven men, and at the informal reception given Tuesday evening at Hotel Walton, to the members, guests and visitors, when this hotel that is finished and furnished in exquisite taste and tints, threw open two cafes and the ladies' reception room and served a banquet both dainty and artistic to palate and eye, each lady was made to feel that she was almost the honored guest of the evening.

After registering, and receiving badges at the Bureau of Registration in the Philadelphia Textile School on Wednesday morning, ladies were invited to attend the meeting of the Association to be held in the Auditorium, and listen to the addresses

*NOTE: The following account of the attention shown to the lady guests at Philadelphia was prepared by one of the ladies of the party. *Secretary.*

and papers, or if they preferred to ride, carriages were at their disposal, or tickets of admission to any place of entertainment or instruction they chose to visit, were given them upon application at the appointed place. The number who chose to attend the meeting was very noticeable.

In the afternoon several ladies accompanied the party of men in an excursion on the Delaware River to Cramp's Ship Yard and to the Baldwin Locomotive Works, while the larger number who preferred to ride were given a luncheon at the Walton, where, at each table one or more ladies of the entertainment committee presided so delightfully that it seemed more like being entertained by a charming acquaintance in her own home than at a strange hotel in a strange city. Lunch over, four tallyho coaches were in waiting at the door, and here again in each coach were two or more fair hostesses, eager to point out any or all places of interest along the beautiful drives through Fairmount Park.

The coaches stopped for an inspection of Memorial Hall, a reminiscence of the Centennial of '76, and at the door and scattered through the building were more ladies waiting to entertain their guests and escort them through the various rooms; a short stop and a merry re-mount, with more riding, when again, at the Sedgely Club House, its President, Miss MARGARET L. CORLEIS, received the guests with welcome and refreshments, after which the ride was finished and the Walton reached in time for dinner.

In the evening, parties of ladies attended places of amusement, to which tickets were generously furnished.

Thursday afternoon, hostesses accompanied ladies to various points of interest in the city, while others accepted an invitation to visit with the members, the Philadelphia Bourse, the most remarkable structure of its kind in America. This was followed by a sumptuous lunch, after which all adjourned to the Philadelphia Museums, two blocks distant, where they were pleased to hear the papers presented, with great enjoyment and future profit. An interesting walk through this building followed the

meeting, during which the members explained and replied to the questions asked by the fair visitors, with as much deference as if they knew the ladies were contemplating entering the cotton manufacturing arena at an early date.

The Philadelphia Art Club, which has special lunch rooms for ladies, furnished visitor's cards to the lady guests of the Association.

Several of the lady guests were recipients of courtesies extended to the Homœpathic Physicians' Association that was being held in the city at this time, and were invited to join any of the outings that had been prepared for these members; and indeed, not only the ladies of the New England Cotton Manufacturers' Association Entertainment Committee, but all the ladies with whom its guests had any intercourse, seemed to be self-constituted, gracious, lovely hostesses.

Thursday evening there was given a Farewell Reception at the Philadelphia Textile School, where leave was taken of the Entertainment Committee who had spared no effort to make Philadelphia seem the most delightful spot on earth, and Philadelphia women the most courteous and hospitable entertainers in the world.

PROCEEDINGS.

In accordance with the legal notice the stated semi-annual meeting of this Association was held in the Auditorium of the Philadelphia Textile School on October 27 and 28, 1897. The following 168 members, accompanied by 53 ladies and 91 gentlemen, making 312, were present at the meeting:

ALFRED E. ADAMS, Supt. Linwood Mills, Whitinsville, Mass.
JOHN S. ADAMS, Jr., Supt. Adams Bros. Manufg. Co., Adams, Mass.
STEPHEN L. ADAMS, Treas. Stafford Mfg. Co., Central Falls, R. I.
JOSEPH D. AIKEN, Ponemah Mills, Taftville, Conn.
GEORGE E. AMES, Mech. Supt. Lawrence Mfg. Co., Lowell, Mass.
ABEL T. ATHERTON, A. T. Atherton Mach. Co., Pawtucket, R. I.
EDWARD ATKINSON, President Boston Mfrs. Mutual Fire Ins. Co., Boston, Mass.
H. C. ATWOOD, Treas. Williamsville Manufg. Co., Killingly, Conn.
CHARLES L. BAILEY, Gen. Supt. Boston Mfg. Co., Box 143, Waltham, Mass.
EDWARD R. BALLOU, 540 W. 23d Street, New York City.
LEWIS E. BARNES, Supt. Methuen Co., Methuen, Mass.
JOSEPH P. BATTLES, 65 Equitable Building, Box 1460, Boston, Mass.
ROBERT BEATTY, Coral and Adams Streets, Philadelphia, Pa.
T. ASHBY BLYTHE, The Ashby Cotton Mills, 114 Chestnut Street, Philadelphia, Pa.
RICHARD B. BORDEN, Treas. Richard Borden Mfg. Co., Fall River, Mass.
THOMAS J. BORDEN, Pres. Richard Borden Manufg. Co., Box 118, Fall River, Mass.
STEPHEN N. BOURNE, Agent Stark Mills, Manchester, N. H.

CHRISTOPHER P. BROOKS, Director Lowell Textile School, Lowell, Mass.
WILLIAM D. CADWELL, Agent Nashua Mfg. Co., Nashua, N. H.
JOHN H. C. CHURCH, Asst. Treas. Monument Mills, Great Barrington, Mass.
JEREMIAH CLARK, 277 Dutton Street, Lowell, Mass.
JOHN A. COLLINS, 73 Cottage Street, Fall River, Mass.
FRANK B. COMINS, Vice-Pres. and Gen. Mangr. Aerphor Co., Box 1555, Providence, R. I.
JOHN J. CONNELL, Supt. Cohannet Mills, Tauuton, Mass.
H. H. CULVER, Supt. Elizabeth Poole Mills, Taunton, Mass.
HENRY S. CULVER, Supt. Cotton Mills, Taunton, Mass.
ANDREW J. CURRIER, Mgr. Albion and Valley Falls Co., Valley Falls, R. I.
WOODBURY K. DANA, Treas. Dana Warp Mills, Westbrook, Me.
J. DEFOREST DANIELSON, Asst. Treas. Lockwood Co., Providence, R. I.
JAMES C. DEANE, Supt. Griswoldville Manufg. Co., Griswoldville, Mass.
CHARLES W. DENNETT, Agent Johnson Mfg. Co., North Adams, Mass.
EDWARD P. DENNIS, Lowell Machine Shop, Lowell, Mass.
GEORGE OTIS DRAPER, Secretary Draper Co., Hopedale, Mass.
RUSSELL W. EATON, Agent Cabot Manufg. Co., Brunswick, Me.
JOHN ECCLES, Supt. Ponemah Mills, Taftville, Conn.
FREDERICK W. ELY, Agent Columbian Mfg. Co., Greenville, N. H.
WILLIAM EVANS. Supt. Richard Borden Mfg. Co., Fall River, Mass.
L. C. FARNSWORTH, Farnsworth Card Clothing Co., Pittsfield, Mass.
WILLIAM FIRTH, 150 Devonshire Street, Boston, Mass.
WILLIAM P. FITTZ, Supt. West Boylston Mfg. Co., Oakdale, Mass.
FREDERICK A. FLATHER, Foreman Lowell Machine Shop, Lowell, Mass.
M. F. FOSTER, Milford, N. H.
EDWARD W. FRANCE, Dir. Philadelphia Textile School, Philadelphia, Pa.
JOSHUA GARSED, Frankford, Philadelphia, Pa.
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MARCELLUS GOULD, Agent Falls Company, Norwich, Conn.
GEORGE P. GRANT, Jr., Treas. Grant Yarn Co., Fitchburg, Mass.
D. W. GRAY, Supt. Skenandoa Cotton Co., Utica, N. Y.
STEPHEN GREENE, 131 Devonshire Street, Boston, Mass.
ARTHUR H. GULLIVER, Asst. Supt. Lonsdale Co., Ashton, R. I.
FRANK J. HALE, Agent Saco and Pettee Mach. Shops, Newton Upper Falls, Mass.
Z. D. HALL, Supt. Berkshire Cotton Mfg. Co., Box 963, Adams, Mass.
A. M. HAMILTON, Supt. Parker Mills, Fall River, Mass.
JOHN P. HAMLET, Box 160, Fall River, Mass.
JOSEPH O. HANNUM, Agt. Saratoga Victory Mfg. Co., Victory Mills, N. Y.

ALFRED H. HARTLEY, Box 409, Fall River, Mass.
WILLIAM B. HAWES, Treas. No. Dighton Cotton Co., Fall River, Mass.
ALFRED HAWKESWORTH, Supt. Merchants Mfg. Co., Montreal, P. Q.
GEORGE W. HOLT, Agent Monohansett Mfg. Co., Putnam, Conn.
WILLIAM P. HOLT, Supt. Wm. A. Slater Mills Corp., Box 315, Slaterville, R. I.
THOMAS HORSFIELD, Supt. Hargraves' Mills, Fall River, Mass.
W. C. HOUSTON, Jr., 333 Drexel Building, Philadelphia, Pa.
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ROLAND R. KELLY, Supt. Williamstown Mfg. Co., Williamstown Sta., Mass.
JOSEPH H. KENDRICK, Agent American Supply Co., Box 850, Providence, R. I.
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HAROLD LAWTON, Gen. Mgr. Warwick Mills, Centreville, R. I.
EVAN ARTHUR LEIGH, 70 Kilby Street, Boston, Mass.
WILLIAM H. LOFTUS, Supt. Clark Thread Co., Newark, N. J.
ARTHUR H. LOWE, Treas. Parkhill Mfg. Co., Fitchburg, Mass.
WILLIAM L. LYALL, J. & W. Lyall, 540 W. 23d Street, New York City.
HENRY F. MANSFIELD, Gen. Supt. Utica Steam Cotton Mills & Mohawk Valley Cotton Mills, Utica, N. Y.
PAUL J. MARRS, Treas. Henderson Cotton Mills, Henderson, Ky.
IRA J. MARTIN, 62 Conant Street, Pawtucket, R. I.
THOMAS MAYOR, 26 Olney Street, Providence, R. I.
ROBERT MCARTHUR, Agt. Pepperell & Laconia Cos., Biddeford, Me.
FRED C. MCDUFFIE, Treas. Everett Mills and York Mfg. Co., Box 2963, Boston, Mass.
JOHN TEMPEST MEATS, Gen. Supt. Mason Machine Works, Taunton, Mass.
DAVID MILNE, Washington Avenue and 11th Street, Philadelphia, Pa.
ALBERT H. MORTON, Supt. Kitson Machine Co., Lowell, Mass.
WILLIAM B. MUNROE, Garwood, N. J.
WILLIAM R. NOONE, 100 Pearl Street, Boston, Mass.
CHARLES K. OLIVER, Treas. Columbia Mills, Columbia, S. C.
ELMER E. PAGE, Agt. York Manufg. Co., Saco, Me.
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LOUIS SIMPSON, Gen. Mgr. Montreal Cotton Co., Valleyfield, P. Q.
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C. H. TRUESDELL, Supt. Attawaugan Co., Killingly, Conn.
O. B. TRUESDELL, Fiskdale Mills, Fiskdale, Mass.
GEORGE F. TRYON, Supt. Conanicut Mills, Fall River, Mass.
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WINTHROP THAYER, 1015 Tremont Building, Boston, Mass.
JUSTIN A. WARE, Crompton-Knowles Loom Works, Worcester, Mass.
WALTER S. WATSON, Box 996, Lowell, Mass.

GUESTS.

BENJ. ANTHONY, Prop. Evening Standard, New Bedford, Mass.
F. B. ABBOTT, Wool and Cotton Reporter, Philadelphia, Pa.
J. R. ALTEMUS, Philadelphia, Pa.
E. P. BORDEN, Philadelphia, Pa.
B. F. BAILEY, Abbe Cotton Mills, Abbeville, S. C.
JOS. T. BRENNAN, New York, N. Y.
JAMES BOOTH, 2545 N. 12th Street, Philadelphia, Pa.
H. S. BULLOCK, Textile Manufacturers' Journal, New York, N. Y.
D. M. BATES, Jr., Joseph Bancroft & Sons Co., Wilmington, Del.
F. B. BARTLETT, Milford, N. H.
JOSIAH CARPENTER, Manchester, N. H.
E. CHAPPELL, H. & B. American Machine Co., Providence, R. I.
CHARLES HEBER CLARK, Publisher and Editor of the Textile Record, Philadelphia, Pa.
HENRY C. CLARK, Providence, R. I.
GEORGE B. COCK, 14 South Broad Street, Philadelphia, Pa.
JOHN G. CARRUTH, Manuf., Indiana Ave. & Rosehill, Philadelphia, Pa.
PAUL T. CHERINGTON, The Manufacturer, Philadelphia, Pa.
J. S. COCHRAN, Jr., Peidmont, S. C.
CLARKSON COWL, New York, N. Y.
PHILIP DANA, Dana Warp Mills, Westbrook, Me.
C. K. DUTTON, M. D., Houlton, Me.
D. D. DONOVAN, Brown & Sharpe Manufg. Co., Providence, R. I.
C. LINCOLN FURBUSH, 224 Market Street, Philadelphia, Pa.
J. E. FRANK, Textile Colorist, Philadelphia, Pa.
E. K. FRANK, Josephs & Frank Co., Pittsburg, Pa.
C. A. GREEN, 233 South Fourth Street, Philadelphia, Pa.

R. E. GREEN, The Georgia Manufg. Co., Gainsville, Ga.
W. R. GARSED, National Spinning Co., Philadelphia, Pa.
J. GOLBERGER, New York, N. Y.
JOHN B. HENCH, Shreveport, La.
FRANK H. HEALD, Milford, N. H.
ARTHUR L. JACOBS, Arthur L. Jacobs & Co., Boston, Mass.
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HENRY G. KITTREDGE, Textile World, Boston, Mass.
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A. L. LANGELLIER, Southern Railway, Boston, Mass.
RICHARD HARRISON LEWIS, 1417 Ridge Avenue, Philadelphia, Pa.
T. H. MARTIN, Secretary Southern Textile Mfrs. Association, Atlanta, Ga.
J. W. MAYOR, Thomas Mayor & Son, Providence, R. I.
J. H. MCADEN, The McAden Mills, Charlotte, N. C.
W. J. MERCER, Journal of Commerce and Commercial Bulletin, New York, N. Y.
E. L. MERROW, National Ring Traveler Co., Providence, R. I.
L. W. MILLER, Principal Philadelphia Textile School, Philadelphia, Pa.
R. M. MILLER, Jr., The Atherton Mills, Charlotte, N. C.
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GEORGE E. PREST, Harmony Mills, Cohoes, N. Y.
H. B. PREST, Cohoes, N. Y.
AMASA PRATT, A. Pratt & Co., Lowell, Mass.
ROBERT PILLING, Pilling Manufg. Co., Philadelphia, Pa.
JAMES H. PARVIN, 116 Chestnut Street, Philadelphia, Pa.
WILLIAM PLATT PEPPER, 1730 Chestnut Street, Philadelphia, Pa.
CHARLES PORTER, Philadelphia, Pa.
EDWARD PRAG, Editor Dyers' Trade Journal, Philadelphia, Pa.
H. F. J. PORTER, The Bethlehem Iron Co., Bethlehem, Pa.
A. G. REIFF, Philadelphia, Pa.
W. C. REINTOLD, Evening Telegraph, Philadelphia, Pa.
HENRY W. ROTH, Philadelphia, Pa.
JAMES G. F. RANDOLPH, Boston, Mass.
E. H. SAMPSON, New York City.
H. H. SUTCHIFFE, Philadelphia, Pa.
HARRY A. STANTON, Evening Telegraph, Philadelphia, Pa.

E. A. SCOTT, Philadelphia, Pa.
WALTER M. SHARPLESS, 123 Chestnut Street, Philadelphia, Pa.
A. SCHULDS, 2940 Petz Street, Philadelphia, Pa.
L. J. SELLING, Philadelphia, Pa.
WILTON H. SPENCER, Providence, R. I.
J. C. SMITH, Chace Mills, Fall River, Mass.
A. SPENCER, Providence, R. I.
DAVID DANA SPEAR, Portland, Me.
J. D. TURNER, Exposition Cotton Mills, Atlanta, Ga.
JOHN P. TRULL, Nevins & Co., Boston, Mass.
E. E. TRAINER, Patterson Mills Co., Chester, Pa.
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BENJAMIN L. TOMES, Dry Goods Economist, New York, N. Y.
B. G. UNDERWOOD, Exchange Building, Boston, Mass.
W. P. WILSON, The Philadelphia Museums, Philadelphia, Pa.
JOSEPH M. WILSON, 1106 Spruce Street, Philadelphia, Pa.
A. W. WHITTAM, Enterprise Co. Mills, Orangeburg, S. C.
STANLEY T. WILLETT, Montreal, P. Q., Dominion of Canada.
H. ARTHUR WHITE, 224 Market Street, Philadelphia, Pa.
WILLIAM WELCH, Hopedale, Mass.
ARTHUR L. WARE, 416 Lombard Street, Philadelphia, Pa.
Hon. CHARLES F. WARWICK, Mayor of Philadelphia.
F. C. WALCOTT, The N. Y. Mills, New York Mills, N. Y.
B. S. WALKER, The Munroe Cotton Mills, Munroe, Ga.
A. S. WATTLES, L. R. Wattles & Co., Canton Junction, Mass.
JAMES L. WHITAKER, Wm. Whitaker & Sons, Philadelphia, Pa.

LADY GUESTS.

Mrs. CELIA L. ANTHONY, New Bedford, Mass.
Mrs. ALFRED E. ADAMS, Whitinsville, Mass.
Mrs. H. C. ATWOOD, Providence, R. I.
Mrs. A. T. ATHERTON, Pawtucket, R. I.
Mrs. JOSEPH P. BATTLES, Boston, Mass.
Mrs. C. P. BROOKS, Lowell, Mass.
Mrs. RANDOLPH CROMPTON, Worcester, Mass.
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Mrs. JOHN A. COLLINS, Fall River, Mass.
Mrs. JOHN J. CONNELL, Taunton, Mass.
Mrs. E. P. DENNIS, Lowell, Mass.
Mrs. C. W. DENNETT, North Adams, Mass.
Mrs. RUSSELL W. EATON, Brunswick, Me.

Mrs. T. C. ENTWISTLE, Lowell, Mass.
Mrs. FREDERICK W. ELY, Greenville, N. H.
Mrs. W. B. FITTZ, Oakdale, Mass.
Mrs. WILLIAM FIRTH, Winchester, Mass.
Mrs. ARTHUR H. GULLIVER, Ashton, R. I.
Mrs. GEORGE P. GRANT, Jr., Fitchburg, Mass.
Mrs. HARRY P. GARLAND, Saco, Me.
Mrs. Z. D. HALL, Adams, Mass.
Miss MAE K. HANNUM, Victory Mills, New York.
Mrs. GEORGE W. HOLT, Putnam, Conn.
Mrs. J. F. HAMLET, Fall River, Mass.
Mrs. ALFRED HAWKESWORTH, Montreal, Canada.
Mrs. HELEN M. C. KENDRICK, Providence, R. I.
Mrs. STEPHEN A. KNIGHT, Providence, R. I.
Mrs. R. R. KELLY, Williamstown, Mass.
Mrs. A. H. LOWE, Fitchburg, Mass.
Miss LENA G. MCARTHUR, Biddeford, Me.
Miss ANNIE E. MEATS, 6 Clinton Street, Taunton, Mass.
Mrs. J. E. NUGENT, Fall River, Mass.
Miss ANGELINE S. NORTON, Boston, Mass.
Mrs. JANE MCARTHUR OWEN, 1130 Walnut Street, Philadelphia, Pa.
Mrs. AMASA PRATT, Lowell, Mass.
Mrs. H. C. PERHAM, Lowell, Mass.
Mrs. WALTER E. PARKER, Lawrence, Mass.
Mrs. HENRY PIERCE, West Boylston, Mass.
Mrs. J. E. PREST, Cohoes, N. Y.
Mrs. JOHN W. PEAD, Lowell, Mass.
Mrs. C. F. M. PRARAY, Providence, R. I.
Mrs. M. W. QUINN, Amesbury, Mass.
Mrs. C. H. RICHARDSON, Lowell, Mass.
Mrs. H. H. SHUMWAY, Taunton, Mass.
Mrs. W. H. SUMMERSBY, Pontiac, R. I.
Mrs. WINTHROP THAYER, Boston, Mass.
Miss AGNES L. TURNER, Centreville, R. I.
Mrs. ROBERT B. TREAT, Centreville, R. I.
Mrs. JUSTIN A. WARE, Worcester, Mass.
Miss LILA WHITING, Oakdale, Mass.
Mrs. A. N. WHITING, Oakdale, Mass.
Mrs. W. S. WATSON, Lowell, Mass.
Mrs. E. C. WILLEY, Manchaug, Mass.
And members of the ladies' auxiliary committee.

FIRST SESSION.

WEDNESDAY, OCTOBER 27, 1897.

Auditorium of the Philadelphia Textile School, Philadelphia.

Meeting called to order at 9.30 A. M. President RUSSELL W. EATON in the Chair.

The Secretary read the following Call to the meeting:—

BOSTON, October 7, 1897.

To the Members:

The stated Semi-annual Meeting of the New England Cotton Manufacturers' Association will be held October 27, 28, at Philadelphia, Pennsylvania.

On Tuesday evening there will be an informal reception by the Local Committee to members of the Association in the hall on the tenth floor of Hotel Walton, corner of South Broad and Locust streets.

The First Session will be held in the Auditorium of the Philadelphia Textile School, the Pennsylvania Museums and School of Industrial Art, 320 South Broad Street, corner Pine Street, Wednesday, October 27, at 9.30 A. M.

The Second Session will be devoted to an excursion Wednesday, October 27, at 1 P. M. Steamer will leave pier, foot of Chestnut Street, Delaware River, for an excursion on the river and a visit to Cramp's shipyards; lunch will be served on the boat. Those who do not care to take the trip to Cramp's shipyards may start from Hotel Walton at 2 P. M., on tallyho coaches and carriages for a drive through Fairmount Park. It will be necessary to learn the wishes of the members as to which trip they will take, sometime during the morning session of Wednesday.

The Third Session will be held in the Assembly Room of the Manufacturers' Club, 1409 Walnut Street, Wednesday, October 27, at 8 P. M.

The Fourth Session will be held in the Auditorium of the Philadelphia Textile School, Pennyslvania Museums and School of Industrial Art, corner South Broad and Pine Streets, Thursday, October 28, at 9.30 A. M.

The Fifth Session, Thursday, October 28, will begin at 12.15 P. M., by an inspection of the Novelties Exhibition in the basement and seventh floor of the Philadelphia Bourse, entering on Fifth Street. At 1 o'clock luncheon will be served in the north gallery, which is reached by elevators. The Session will be held in the hall of the Philadelphia Museums, 233 South Fourth Street, at 2 P. M.

The Sixth Session will be held in the Auditorium of the Philadelphia Textile School, Thursday, October 28, at 8 P. M.

Tickets for any of the theatres will be provided for either evening for those who may desire them, and carriages will be furnished whenever desired. Application should be made at the Committee Room in Bureau of Registration.

Attention is called to the programme for further detail.

The Franklin Institute of Pennsylvania, South Seventh Street, between Chestnut and Market Streets, invite the members to call at their building, where there are many objects of interest in connection with early American inventions, and an extensive library.

The arrangements for the meeting at Philadelphia are in the hands of a Local Committee, consisting of Messrs.

JAMES BUTTERWORTH, *Chairman*,
JOHN P. WOOD, *Vice-Chairman*,
EDWARD W. FRANCE, *Secretary*, 320 South Broad Street, Philadelphia, Pa.,

And is divided into the following sub-committees:

EXECUTIVE COMMITTEE.

JAMES BUTTERWORTH, *Chairman*,
EDWARD W. FRANCE, *Secretary*,
JOHN H. CONVERSE,
THOMAS DOLAN,
M. A. FURBUSH.
T. C. SEARCH,
S. S. SPENCER,
JOHN P. WOOD,
WILLIAM T. GALEY.

FINANCE COMMITTEE.

WILLIAM T. GALEY, *Chairman*,
T. STEWART WOOD, *Treasurer*,
WILLIAM H. ARROTT,
J. G. CARRUTH,
LINCOLN GODFREY,
GEO. H. MCFADDEN,
W. W. FOULKROD,
DAVID MILNE,
JAMES E. MITCHELL,
F. W. SHARPLES,
J. B. MORGAN,
JOSEPH H. PARVIN,
GEORGE WOOD,
WILLIAM WOOD.

ENTERTAINMENT COMMITTEE.

M. A. FURBUSH, *Chairman*.
JAMES W. NAGLE, *Secretary*.
CHARLES B. ADAMSON,
HENRY BROOKS,
WILLIAM H. BROMLEY,
JAMES H. BILLINGTON,
CHARLES HEBER CLARK,
WILLIAM DONOVAN,
WILLIAM W. FOULKROD,
JOHN H. FOSTER,
JOHN GREENWOOD,
JOHN HOYLE,
W. C. HOUSTON, JR.,
CHARLES MCCLOUD,
JAMES MCMASTER,
JOHN H. MICHENER, JR.
THEODORE F. MILLER,
L. W. MILLER,
DAVID C. NIMLET,
JOSEPH H. PARVIN,
WILLIAM PLATT PEPPER,
ROBERT PILLING,
J. K. RUSSELL,
CHARLES H. SALMON,
EDWARD H. SANBORN,
OTTO SCHAUM,
WILLIAM T. TILDEN,
J. P. TRUITT,
WILLIAM P. WILSON.

The following associate committee of ladies will make arrangements for the entertainment of ladies accompanying members to the meeting:

Mrs. E. D. GILLESPIE, *President*,
Mrs. JOHN SANDERS, *Vice-President*,
Miss FANNIE S. MAGEE, *Secretary*,
Mrs. E. E. DENNISTON, *Treasurer*,
Mrs. JAMES W. BURLING, *Registrar*,
Mrs. S. H. AUSTIN,
Mrs. SINGERLY BALCH,
Mrs. CHENEY-BARTOL,
Mrs. C. WILLIAM BERGNER,
Miss ANNIE BLANCHARD,
Mrs. WILLIAM CARTER,
Miss MARY COHEN,
Miss MARGARET L. CORLIES,
Miss ADA M. CROZER,
Mrs. WILLIAM L. ELKINS,
Mrs. R. RODMAN ELLISON,
Mrs. JOSEPH HARRISON,
Mrs. DANIEL H. HASTINGS,

Mrs. MORRIS JASTROW, Jr.,
Mrs. ROBERT MILLER JANNEY,
Miss M. ATHERTON LEACH,
Mrs. CRAIGE LIPPINCOTT,
Miss ELLEN MCMURTRIE,
Mrs. DANIEL S. NEWHALL,
Mrs. EDWARD H. OGDEN,
Mrs. THOMAS A. REILLY,
Mrs. THOMAS ROBERTS,
Miss ELIZABETH C. ROBERTS,
Mrs. JOSEPH F. SINNOTT,
Mrs. THEODORE VOORHEES,
Mrs. FRANCIS H. WILLIAMS,
Mrs. JONES WISTER,
Mrs. CHARLES F. WARWICK,
Miss H. A. ZELL.

The headquarters of the Association will be at Hotel Walton (European plan), on the southeast corner of Broad and Locust Streets.

It is suggested that members desiring to stop there write to the hotel, where a number of rooms will be held in reserve for accommodation of the members. Other hotels in the vicinity are the LaFayette, Stenton, Bellevue, Stratford and Collonade.

Members, guests and the Local Committee will receive distinctive badges of registration.

Persons proposed for membership are invited to attend the meeting and participate in all of the exercises.

Notifications of election and bills to the new members will be sent to them by mail after the conclusion of the meeting.

Blank propositions for membership can be obtained from the inside cover of the Transactions. Extra copies will be sent on request.

It is desired that propositions for membership should be mailed to the Secretary as early as convenient.

Members can attend the convention at reduced rates of fare by complying with the following conditions: When purchasing the ticket to Philadelphia full fare one way is to be paid, and obtain from the ticket agent a certificate that such a ticket has been purchased for the meeting of the New England Cotton Manufacturers' Association at Philadelphia, October 27 and 28. On arrival at Philadelphia this certificate is to be given to the Secretary of the Association, and if one hundred certificates are given, the railroad companies will make the following concessions effective:

On presentation of the certificates, signed by the Secretary and the representative of the railroads, a return ticket can be purchased for one-third the regular fare, making the whole cost for the round trip at one and one-third the regular transportation for both ways. The railroad companies will give the concession only by conformity to the

above, and as one hundred are necessary it is hoped that everyone will ask for certificates, for the guests who accompany them, as well as for themselves.

Ticket offices of the Royal Blue Line and Pennsylvania Line are in the Rogers Building, Washington Street. Those whose time is limited and do not care to take either boat or sleeper, can leave Boston from the Park Square station at 9 A. M., October 26th, and reach Philadelphia at 6.05 P. M.

Persons going to Philadelphia from New York can obtain the usual limited round trip ticket at a reduced rate. Those arriving in New York at the Grand Central Station on Forty-second Street, if they desire to take the Bound Brook Route to Philadelphia, will find it more convenient to take the Third Avenue elevated to the South Ferry Station, where they will obtain at the Whitehall Slip a boat which will take them to the station in Jersey City. Those who come from New York to Philadelphia via Pennsylvania Railroad will find it more convenient to take street cars down Madison Avenue to Twenty-third Street, and there take street cars going west on Twenty-third Street to the new ferry of the Pennsylvania Railroad.

There is no public conveyance on Broad Street. Street cars run south on Fifteenth Street, and north on Thirteenth Street. They also run west on Spruce Street, which is near the School, and west on Pine Street, east on Chestnut, west on Sanson and Walnut Streets, and both east and west on Market Street. Exchange tickets will be given in the street cars for eight cent fares, if the request is made when the fare is paid; single fares are five cents.

The Southern Railway Company extends to the New England Cotton Manufacturers' Association an invitation to visit, after the meeting, the cotton manufacturing district on their lines, which begin at Washington and reach 249 cotton mills. A representative of the railway company will attend the meeting for the purpose of making arrangements with any of those who will accept this invitation. It will be preferable that they form in groups or parties. The Atlanta & West Point Railway Company, the Seaboard Air Line, and the Kansas City, Pittsburgh & Gulf Railway Company also extend similar courtesies.

By order of the Board of Government,

C. J. H. WOODBURY,

Secretary.

PROGRAMME OF PHILADELPHIA MEETING, No. 63.

Preliminary.

On Tuesday evening, October 26, there will be an informal reception to the members and lady guests at Hotel Walton with music, refreshments, smoking-room, etc., by the courtesy of the Local Committee.

First Session, Wednesday October 27, 1897, at 9.30 A. M.

Auditorium of the Philadelphia Textile School, the Pennsylvania Museums and School of Industrial Art, corner of 320 South Broad and Pine Streets, Philadelphia.

Call to order: President RUSSELL W. EATON in the chair.

Business.

Address.

Hon. CHARLES F. WARWICK, *Mayor of Philadelphia.*

Address.

Mr. THEODORE C. SEARCH, *President National Association of Manufacturers*, Philadelphia.

Influence of the Artistic in Textile Designing.

Mr. EDWARD W. FRANCE, *Director of the Philadelphia Textile School*, Philadelphia.

At the conclusion of this paper a recess of one hour will be taken to enable the members to inspect the Philadelphia Textile School.

Modifications in Mill Design Resulting from Changes in Motive Power.
Mr. STEPHEN GREENE, Boston, Mass.

TOPICAL QUESTION.

81. In what particular is the mule as built today, an improvement for spinning fine numbers over those of ten years ago?

At 12.30 P. M. the Session stands adjourned, and carriages will take the members to the Chestnut Street pier.

Second Session, Wednesday, October 27, 1897, at 1 P. M.

Pier foot of Chestnut Street, Delaware River.

Excursion on the river on Steamer Columbia and visit to Cramp's shipyard; lunch will be served on the boat. For those who may not care to take the trip on the river, a drive through Fairmount Park in tallyho coaches and carriages will be provided. Lunch will be served to those who take the drive at the Hotel Walton at 1 o'clock, and the carriages and coaches will start from the hotel at 2 o'clock. As the tallyho coaches will accommodate only a fixed number, it will be necessary to book at the Bureau of Registration at the Philadelphia Textile School before 12 o'clock. During the drive Memorial Hall will be visited, and on the return the President will serve tea to the party at the Sedgely Club House at Fairmount.

Third Session, Wednesday, October 27, 1897, at 8 P M..

Assembly Rooms of the Manufacturers' Club, 1409 Walnut Street.
Take elevator to the third floor.

This Session will be devoted to an informal smoke talk during which it is expected that there will be opportunity for discussion upon the following papers presented before the Spring Meeting of 1897, but which were not discussed at the time of their delivery.

Picking and Carding.
Mr. MARCELLUS GOULD, Norwich, Conn.

To be discussed by Messrs. THEOP. W. WILMARTH, EBEN C. WILLEY, ARTHUR H. GULLIVER, CHARLES L. BAILEY, and others.

Weaving as a Fine Art.

Mr. ALFRED HAWKESWORTH, Montreal, Can.

To be discussed by Mr. JOHN ECCLES, and others.

Ring Spinning.

Mr. ALFRED E. ADAMS, Whitinsville, Mass.

To be discussed by Messrs. JOHN W. PEAD, IRA J. MARTIN, and others.

In order to preserve the informal character of the Session, the stenographer will not be present and the records of the proceedings will not form any portion of the published Transactions except when speakers furnish their manuscript.

Entertainment and refreshment will be provided by the Club during the evening.

Fourth Session, Thursday, October 28, 1897, at 9.30 A. M.

Philadelphia Textile School, the Pennsylvania Museums and School of Industrial Art.

Power Testing on Frame Spindles.

Mr. GEORGE OTIS DRAPER, Hopedale, Mass.

TOPICAL QUESTIONS.

85. Spinning rings: Does anyone know how to make them and how large is it advisable to have them on the different numbers of yarn to be spun?

86. Is it practical to spin numbers finer than 65s on larger rings than 1½ with spindle running 9,000 revolutions?

89. What is the best temperature and humidity for good spinning on fine counts?

Improved Methods of Drying Goods.

Mr. JAMES A. WALSH, Lewiston, Maine.

Old Style Carding *vs.* New Style Carding.

Mr. JOHN R. MASON, Fall River, Mass.

The Purpose of Textile Education.

Mr. C. J. H. WOODBURY, Boston, Mass.

At 12.15 P. M., the sessions stand adjourned and carriages will take the party to the Fifth Street entrance of the Philadelphia Bourse.

Fifth Session, Thursday, October 28, 1897.

The Session will be held at 2 P. M., at the Hall of the Philadelphia Museums, 233 South Fourth Street.

At 12.15 P. M., the members will proceed to the Fifth Street entrance of the Philadelphia Bourse, between Market and Chestnut Streets, for an inspection of the Novelties Exhibition in the basement and seventh floor. At 1 P. M. lunch will be served in the north gallery, which is reached by elevators.

Movement and Statistics of Cotton Goods.
Prof. WILLIAM P. WILSON, Sc. D., *Director Philadelphia Museums*, Philadelphia.

The Manufacture and Export Trade of Cotton Goods.
Mr. ARTHUR PARKINSON, New York, N. Y.

Imports of Cotton Goods.
Mr. FRANK P. BENNETT, Boston, Mass.

Progress in Cotton Manufacturing in Russia.
Mr. VLADIMIR P. POLEVOY, New York, N. Y.

The Growth of the Modern Factory System.
Mr. ALFRED M. GOODALE, Boston, Mass.

The Cotton Yarn Preparation Department of the Lowell Textile School.
Mr. CHANNING WHITAKER, Lowell, Mass.

After this session the members will have an opportunity for the inspection of the Museums.

Sixth Session, Thursday, October 28, 1897, at 8 P. M.

Philadelphia Textile School, the Philadelphia Museums, and School of Industrial Art.

Business.

Philadelphia as a Textile Manufacturing Centre.
Mr. CHARLES HEBER CLARKE, *Publisher and Editor of the Textile Record*, Philadelphia.

Comparative Life of Cotton Machinery.
Mr. EDWARD W. THOMAS, Lowell, Mass.

Repair Shops.

Mr. FRANK M. MESSENGER, North Grosvenor Dale, Conn.

Mill Repair Shops.

Mr. D. D. DONOVAN, Providence, R. I.

The Proper Construction and Uses of Economizers.

Mr. HENRY G. BRINCKERHOFF, Boston, Mass.

Some Vital Points Concerning Fire Protection of Mill Property.

Mr. WILLIAM H. STRATTON, Hartford, Conn.

TOPICAL QUESTIONS.

87. What is the maximum length to put No. 100s on bobbin?

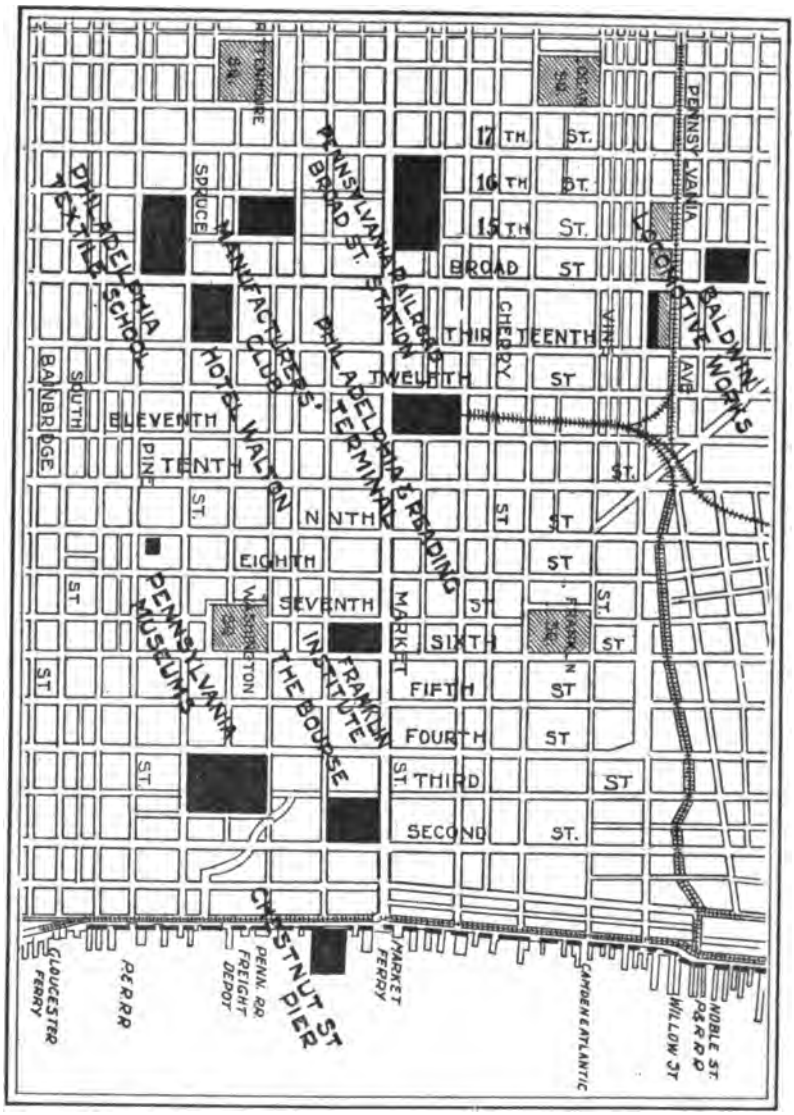
90. Do you consider it practical to spool No. 120s yarn with the Wade bobbin holder?

Tickets for any of the theatres will be provided for either evening for those who may desire them, and carriages will be furnished whenever desired.

The Western Union Telegraph Company, and the Postal Telegraph Company will transmit personal messages; the Bell Telephone Company of Philadelphia will have a booth for local service, and the American Telephone and Telegraph Company a booth for long distance communication between 6 P. M. and 9 A. M., without charge on presentation of badges.

Application should be made at the Committee Room in Bureau of Registration, where badges and all local information may be obtained.

C. J. H. WOODBURY,
Secretary.


PENNSYLVANIA
LOCOMOTIVE
BALDWIN WORKS
17 TH ST.
16 TH ST.
15 TH ST.
BROAD ST
PENNSYLVANIA RAILROAD STATION
BROAD ST.
CHERRY
THIRTEENTH
VINE
TWELFTH ST
PHILADELPHIA & READING TERMINAL
PHILADELPHIA TEXTILE SCHOOL
SPRUCE
MANUFACTURERS' CLUB
HOTEL WALTON
PINE
TENTH ST.
NINTH ST
EIGHTH ST
SEVENTH ST
MARKET ST
SIXTH ST
FIFTH ST
FOURTH ST
THIRD ST
SECOND ST.
FRANKLIN
WASHINGTON SQ.
PENNSYLVANIA MUSEUM
FRANKLIN INSTITUTE
THE BOURSE
CHESTNUT ST PIER
MARKET FERRY
PENN. RR. FREIGHT DEPOT
PERRR
GLOUCESTER FERRY
CAMDEN & ATLANTIC
NOBLE ST. P&R R'D
WILLOW ST
BANBRIDGE
SOUTH

The SECRETARY. Mr. President, I certify that I have mailed the Call to the Meeting to every member, at least ten days in advance of the present date, in accordance with Article XIV. of the Constitution of the Association and that a quorum is now present.

The records of the Sixty-second Meeting of the Association were read by the Secretary and it was voted that they should be accepted.

The Secretary read the following correspondence:

Executive Mansion,

WASHINGTON.

The President
Regrets his inability to accept the courteous invitation of
The President and Directors of the
New England Cotton Manufacturers Asssociation
to attend the
Sixty-third meeting of the Association
At the Auditorium of the Philadelphia Textile School,
Wednesday and Thursday,
October Twenty-seventh and Twenty-eighth.

Monday,
October eleventh,
1897.

Commonwealth of Pennsylvania,

Executive Chamber,

HARRISBURG.

October 22, 1897.

Mr. C. J. H. WOODBURY,
Secretary New England Cotton Mfrs.' Association,
John Hancock Building, Boston, Mass.

Dear Sir:

Governor HASTINGS directs me to acknowledge the kind invitation of

1st inst., which you extend him on behalf of the President and Directors of your Association, to attend the sixty-third meeting in the Auditorium of the Philadelphia Textile School on Wednesday and Thursday, October 27th and 28th, and to sincerely regret that the death this morning of his banking partner and the pressure of official duties together, will render it impossible for him to avail himself of the invitation you so courteously extend, and he can but express the hope that your meeting may be attended by every possible success.

Very truly yours,

LEONI E. BEITLES,
Private Secretary.

THE FRANKLIN INSTITUTE
OF THE STATE OF PENNSYLVANIA.
PHILADELPHIA, October 9, 1897.

C. J. H. WOODBURY, *Secy.*,
The New England Cotton Mfrs.' Association,
Boston, Mass.

Dear Sir:

On behalf of the the officers of this Institute, I wish to express my thanks for the courteous invitation extended to them to attend the Sessions of your Association in Philadelphia.

Should any of your members wish to visit the Institute, they will be made very welcome, and will be afforded every attention which the present disarranged state of our building will enable the officers to extend to them.

Wishing the Association a pleasant and fruitful session, I am, dear sir,

Sincerely yours,

WILLIAM H. WAHL,
Secretary.

SOUTHERN RAILWAY COMPANY,
WASHINGTON, D. C., October 2, 1867.

To the New England Cotton Mfrs.' Association,
Boston, Mass.

Dear Sirs:

It affords us pleasure to extend to your Association an invitation to visit the cotton manufacturing districts reached by the Southern Railway.

We shall be glad to afford your Association as a body, the courtesies of the line to visit any of the mill centres along our system. We are of the opinion you will find much to interest you at this time in that we have 249 cotton mills along our line, and favorable prospects of a large increase.

Should your Association find it convenient to accept this invitation, kindly advise the undersigned in order that the details of the trip can be arranged.

Yours very truly,

M. V. RICHARDS,
Land and Industrial Agent.

SOUTHERN RAILWAY COMPANY,
WASHINGTON, D. C., October 11, 1897.

To the New England Cotton Mfrs.' Association,
Boston, Mass.

Dear Sirs:

In connection with the invitation extended your Association to visit the cotton manufacturing districts along the line of the Southern Railway, I beg to extend to you an invitation on behalf of the Atlanta & West Point Railway Company, at the request of its President, for your Organization to include that road in your southern itinerary.

We shall esteem it a favor if you will advise us of the acceptance of this, so that we, in turn, may inform the Atlanta & West Point people.

Trusting that both invitations may receive favorable notice by the majority of members of the New England Cotton Manufacturers' Association, I have the honor to remain,

Yours very respectfully,

M. V. RICHARDS,
Land and Industrial Agent.

The SECRETARY. In accordance with these letters, Mr. A. L. LANGELLIER of the Southern Railway Company will be in attendance at the meeting, when he will also represent the Atlanta & West Point Railway Company in extending courtesies to the members, and make such arrangements for transportation as may meet the convenience of the members.

We have also received an invitation on the part of the Seaboard Air Line by E. ST. JOHN, vice-president:

Leaving Philadelphia Friday morning, party would proceed to Old Point Comfort, Va., spending the night there.

Leaving Saturday morning, the party would proceed to Portsmouth, where a special Seaboard train would be in readiness. This train would consist of two private cars and one Pullman car.

The route would be Portsmouth, Norfolk, Weldon, Raleigh (here the party would probably spend Sunday), Charlotte, Munroe, Greenwood, Columbia, Elberton, Athens and Atlanta. The return would be back to Portsmouth. This trip would require about one week.

The expenses would be $2.00 per day for Pullman fare. No charge for transportation. When convenient, meals would be eaten at eating houses on the way, at a cost of 50 cents each. Other meals would be furnished on the train by the Seaboard Company without charge.

This invitation is extended to a party of not less than twenty. If the party is not made up now, the invitation will be renewed in the latter part of the winter, say in February or March.

The train will run special, and will stop at cotton mills, water powers, and important cities.

This list will be at the Bureau of Information, in the hands of the Secretary, and in the hands of Mr. D. A. TOMPKINS.

Those wishing to accept may indicate by signing one of the above papers.

The SECRETARY. It was the desire of the Kansas City, Pittsburg & Gulf Railway, to extend the courtesy of that line which runs from Kansas City, Mo., to Port Arthur on the Gulf of Mexico, to the Association, but on account of the prevalence of yellow fever, although it is stated there are no cases along the line of this railroad, yet travelers might be held by a quarantine, and Mr. F. M. MOORE, the New England passenger agent, has written a letter dated October 25th, stating that under the circumstances it appears inexpedient to present the invitation. With that letter was the following communication:

KANSAS CITY, PITTSBURG & GULF RAILWAY CO.,
BOSTON, MASS., October 25, 1897.

The New England Cotton Mfrs.' Association,

Gentlemen:

The Kansas City, Pittsburg & Gulf Railway, through its President, Mr. A. E. STILWELL, wishes to draw the attention of the members of this Association to the fact that the terminal city of our railroad, situated near the Gulf in Jefferson County, Texas, is well adapted for the location of cotton mills. The town has been located far enough away from the Gulf and high enough from tide water to make it well drained and healthy.

It is a town of a few years' growth, but that growth has been done mostly by enterprising men of the North. It is so located that it will in the near future be the shipping point for an enormous quantity of cotton raised not only in the immediate vicinity, but throughout the western and central part of Louisiana and Askansas and the central and eastern part of Texas and Indian Territory. Its harbor has been called one of the best on the Gulf, and with the steamship lines now established to the ports of Mexico, Central America and the West Indies, it will become one of the great shipping points for manufactured products.

The railroad company is in a position, with the subordinate companies connected with it, to offer inducements for the establishment of cotton mills at this point, and it has been noted that well managed southern cotton mills established where railroad rates and facilities were correspondingly good, have proved very successful.

We would be pleased to communicate with all those capitalists who are contemplating the establishment of mills in the South, and will endeavor in every way to give them the facilities whereby they can investigate the advantages that Port Arthur and our road offer for such an enterprise.

Yours very truly,

F. M. MOORE,
New England Passenger Agent.

The SECRETARY. I beg to present for the consideration of the Association a ballot of names proposed for membership, with the approval of the Board of Government.

FOR HONORARY MEMBERSHIP.

JONES S. DAVIS, Holyoke, Mass., retired.
Proposed by vote of the Board of Government.

FOR ACTIVE MEMBERSHIP.

THOMAS ARMSTRONG, Supt. North Pownal Manufg. Co., No. Pownal, Vt.
By Mr. JOHN F. HAMLET.

ROBERT BEATTY, Robert Beatty & Co., Coral and Adams Sts., Philadelphia, Pa.
By Mr. E. A. LEIGH.

JOHN BELL, Manager Smith & Dove Manufg. Co., Andover, Mass.
By Mr. WALTER E. PARKER.

A. C. BENT, Agent Safety Seamless Pocket Co., Taunton, Mass.
By Mr. THOMAS G. COX.

T. ASHBY BLYTHE, Prop. Ashby Cotton Co., 114 Chestnut St., Philadelphia.
By Mr. WILLIAM B. HAWES.

JOHN P. BODGE, Treas. Arkwright Mills, Fall River, Mass.
By Mr. F. J. HALE.

THOMAS J. BROWN, George Brown's Sons, Mount Joy, Pa.
By Mr. JOHN ECCLES.

GEORGE DEFOREST, Treas. Mohawk Valley Mills and Utica Steam Cotton Mills, Utica, N. Y.
By Mr. GEORGE H. SAYWARD.

JOHN W. DICKINSON, Supt. Lyman Mills, Holyoke, Mass.
By Mr. JAMES C. DEANE.

CHARLES F. FARRAR, Supt. Wm. A. Slater Mills Corp., Jewett City, Ct.
By Mr. WM. P. HOLT.

JOSHUA GARSED, Garsed & Co., Frankford, Philadelphia, Pa.
By Mr. JOHN ECCLES.

THOMAS HORSFIELD, Supt. Hargrave's Mill, Fall River, Mass.
By Mr. WILLIAM EVANS.

D. EDWIN IRVING, Treas. The Irving & Leiper Mfg. Co., Chester, Pa.
By Mr. W. E. TRAINER.

JOHN LEIPER, Supt. Fitchburg Manufg. Co., West Fitchburg, Mass.
By Mr. JOHN F. HAMLET.

B. F. G. LINNELL, Agt. Greene & Daniels Mfg. Co., Pawtucket, R. I.
By Mr. ARTHUR H. LOWE.

WM. H. LOFTUS, Supt. Clark Thread Co., Newark, N. J.
By Mr. HERBERT E. WALMSLEY.

A. P. MALCOLMSON, Supt. The Wm. A. Slater Mills Corp., Jewett City, Ct.
By Mr. J. COLBY LEWIS.

PAUL J. MARRS, Treas. Henderson Cotton Mills, Henderson, Ky.
By Mr. F. A. FLATHER.

W. H. RICHARDSON, Supt. Bibb Mill, No. 2, Macon, Ga.
By Mr. H. E. FISHER.

HENRY B. SAWYER, Asst. Treas. Newmarket Manufg. Co., 45 Milk St., Boston, Mass.
By Mr. J. HERBERT SAWYER.

F. C. SAYLES, Pres. Ponemah Mills, Pawtucket, R. I.
By Mr. WILLIAM WHITTAM, Jr.

JOHN SMITH, Supt. Chace Mills, Fall River, Mass.
By Mr. WILLIAM EVANS.

CHARLES D. TURNBULL, Treas. Wm. A. Slater Mills Corp., The Ludlow, Boston, Mass.
By Mr. WM. P. HOLT.

CHARLES D. WHITE, Agent Uncasville Mfg. Co., Uncasville, Ct.
By Mr. JOHN ECCLES.

FOR ASSOCIATE MEMBERSHIP.

HARRY W. BUTTERWORTH, Sec. H. W. Butterworth & Sons Co., 2417 East York St., Philadelphia, Pa.
By Mr. FRED C. MCDUFFIE.

FRENCH CAMPBELL, Commission Merchant, Manchester, N. H.
By Mr. S. N. BOURNE.

GEORGE CROMPTON, Treas. Crompton-Knowles Loom Works, Worcester, Mass.
By Mr. JUSTIN E. WARE.

RANDOLPH CROMPTON, Asst. Treas. Crompton-Knowles Loom Works, Worcester, Mass.
By Mr. JUSTIN E. WARE.

FREDERICK A. DOWNES, Sec. Factory Mutual Fire Insurance Co., 925 Chestnut St., Philadelphia, Pa.
By Mr. C. R. MAKEPEACE.

L. C. FARNSWORTH, Farnsworth Card Clothing Co., Pittsfield, Mass.
By Mr. JOHN ECCLES.

MERRILL A. FURBUSH, M. A. Furbush & Son Machine Co., 224 Market St., Philadelphia, Pa.
By Mr. JOHN ECCLES.

HENRY T. GRANT, Jr., Pres. Mercantile Mutual Fire Insurance Co., Box 1153, Providence, R. I.
By Mr. STEPHEN MINOT PITMAN.

ALFRED H. HARTLEY, Dealer in Oils and Mill Supplies, Box 409, Fall River, Mass.
By Mr. JOHN F. HAMLET.

ALFRED A. HUNTING, Mechanical Engineer, 10-12 Federal St., Boston, Mass.
By Mr. H. L. PRATT.

JOHN H. LORIMER, Scouring, Dyeing and Drying Machinery, Ontario and Lawrence Sts., Philadelphia, Pa.
By Mr. F. C. MCDUFFIE.

WILLIAM R. NOONE, Manuf. of Roller and Slasher Cloth, 100 Pearl St., Boston, Mass.
By Mr. JOHN ECCLES.

LOUIS E. ROBINSON, Sea Island Cotton, 20 Market Sq., Providence, R. I.
By Mr. GEORGE A. FULLER.

JAMES STRANG, Selling Agent Metallic Drawing Roll Co., Indian Orchard, Mass.
By Mr. EDWARD W. THOMAS.

The PRESIDENT. I will appoint Mr. E. A. LEIGH and Mr. LOUIS SIMPSON a committee to receive, sort, count the votes and report at a later session.

Hon. CHARLES F. WARWICK, the Mayor of Philadelphia, then delivered an address welcoming the organization to the city. He was followed by Mr. THEODORE C. SEARCH of Philadelphia, President of the National Association of Manufacturers, who gave an address on "American Cotton Goods Abroad". Mr. EDWARD W. FRANCE, Director of the Philadelphia Textile School, read a paper on "The Influence of the Artistic on Textile Designing", after which Prof. L. W. MILLER gave a few directions in regard to the method of visiting the school, when a recess of an hour was taken to enable the members to inspect the school.

Mr. STEPHEN GREEN of Boston, Mass., read a paper on "Modifications in Mill Design Resulting from Changes in Motive Power".

Topical Question No. 81, "In what particular is the mule as built today, an improvement for spinning fine numbers over those of ten years ago"? was discussed by Messrs. H. G. MCKERROW, WILLIAM WHITTAM, Jr., JOHN T. MEATS and E. A. LEIGH.

SECOND SESSION.

WEDNESDAY, OCTOBER 27, 1897, AT 12.30 P. M.

At 12.15 P. M. the session adjourned and the party was taken in carriages to the Chestnut Street Pier, where they embarked on the Steamer Columbia, furnished by the courtesy of the Delaware River Transportation Company. Lunch was served on the steamer, which first sailed down the Delaware River to its confluence with Schuylkill, where a fine view was presented of the United States Navy Yard at League Island; then turning northward the party landed at Cramp's Shipyard, where they were received by the officers of the company and escorted over the extensive establishment, viewing the following vessels in process of construction:

The United States first-class Battleship "Alabama", 11,500 tons, 16 knots.

The Japanese Protected Crusier "Kasagi", 5,000 tons, 22½ knots.

The Passenger Steamship "Miami" for service between Florida and the Bahamas.

The U. S. Revenue Cutter "McCulloch", 1,200 tons (completing for sea).

The steel sea-going Steam Yacht "Dorothea", for THOMAS MCKEAN, Esq., Philadelphia.

This enormous plant was founded by WILLIAM CRAMP in 1830 with a capital of $50,000; it was afterwards incorporated in 1872

with $500,000 capital, and increased in July, 1890, to $5,000,000 capital.

The ground area of the shipyard is thirty-three acres. The water front, including the basin, dry dock, and marine railway is 1,546 feet.

The Cramp Company is now building its two hundred and ninety-third ship, and its one hundred and sixty-seventh marine engine. Cramp built the first steam tug, the first compound, the first triple expansion and the first and largest quadruple expansion sea-going engines in the United States. It owns and operates the Morris Works, which have built nine hundred and ten engines, mainly stationary.

The Cramp Company has had under construction, simultaneously, 116,000 tons of displacement and 252,000 indicated horse-power of machinery, employing 6,500 men, and involving over $20,000,000 in contract prices.

Since 1885 the Cramp Company has built, or is building for the United States Navy, four battleships, two armored cruisers, five protected cruisers, one gunboat and torpedo vessel, and one double-turreted coast defence vessel, having an aggregate displacement of 95,000 tons, and a total indicated horse-power of 158,000; involving twenty-five million dollars in contract prices, exclusive of premiums for excess of guaranteed performance.

After leaving Cramp's Shipyard, the party was taken in carriages to the Baldwin Locomotive Works, where it witnessed locomotives in various stages of construction and viewed with especial interest the organization of cranes and tracks for the rapid movement of the goods in process of construction.

THIRD SESSION.

WEDNESDAY, OCTOBER 27, AT 8.30 P. M.

The third session was held at the Manufacturers' Club, 1409 Walnut street, President RUSSELL W. EATON in the chair. The club house was finely decorated with cotton plants from Columbia, S. C. The session was devoted to an informal consideration of papers read at the Spring Meeting at Boston, but which time did not permit of their discussion.

"Picking and Carding", by Mr. MARCELLUS GOULD, Norwich, Conn. Discussed by Messrs. THEOP. W. WILMARTH, EBEN C. WILLEY, ARTHUR H. GULLIVER and CHARLES L. BAILEY.

"Weaving as a Fine Art," by Mr. ALFRED HAWKESWORTH, Montreal, Can. Discussed by Mr. JOHN ECCLES.

"Ring Spinning," by Mr. ALFRED E. ADAMS, Whitinsville, Mass. Discussed by Messrs. JOHN W. PEAD, IRA J. MARTIN and EDWARD ATKINSON.

The Secretary read the following telegram:

COLUMBIA, S. C., October 26, 1897.

The City Council have voted to invite the New England Cotton Manufacturers' Association to hold its next meeting here and to visit Columbia on the adjournment of the present meeting, and have appointed a committee to present the invitation.

W. McB. SLOAN, *Mayor.*

On motion duly seconded, it was voted to refer the communication from the Mayor of Columbia, S. C., to the Board of Government.

FOURTH SESSION.

THURSDAY, OCTOBER 27, 1897, AT 9.30 A. M.

The fourth session was held at the Philadelphia Textile School, President RUSSELL W. EATON in the chair.

Mr. GEORGE OTIS DRAPER, of Hopedale, read a paper on "Power Testing on Frame Spindles," which was discussed by Messrs. EDWARD ATKINSON, LOUIS SIMPSON, D. D. DONOVAN and JOHN T. MEATS.

Topical Question No. 85, "Spinning rings: Does anyone know how to make them and how large is it advisable to have them on the different numbers of yarn to be spun?" was discussed by Messrs. JOHN T. MEATS, HENRY T. WHITIN, ARTHUR H. GULLIVER, GEORGE OTIS DRAPER, ROBERT MCARTHUR and JOHN ECCLES.

Topical Question No. 86, "Is it practical to spin numbers finer than 65s on larger rings than 1½ with spindle running 9,000 revolutions?" was passed over without discussion.

Topical Question No. 89, "What is the best temperature and humidity for good spinning on fine counts?" was discussed by Messrs. EDWARD ATKINSON and C. J. H. WOODBURY.

A paper on "Improved Methods of Drying Goods" was read by Mr. JAMES A. WALSH, of Lewiston, Maine, and discussed by Mr. OWEN.

The next paper, "Old Style Carding *vs.* New Style Carding" was read by Mr. JOHN R. MASON, of Fall River, Mass.

"The Purpose of Textile Education" by Mr. C. J. H. WOODBURY, of Boston, Mass.

Mr. LOUIS SIMPSON of the committee on balloting for new members reported that 101 ballots were cast, and that all of the candidates were elected.

FIFTH SESSION.

HALL OF THE PHILADELPHIA MUSEUMS, THURSDAY, OCTOBER 28, 1897, 2 P. M.

Meeting called to order, President RUSSELL W. EATON in the chair.

Previous to session the members inspected the Novelties Exhibition in the basement and seventh floor of the Philadelphia Bourse, after which they were served with lunch in the gallery of the Bourse.

"Movement and Statistics of Cotton Goods," was read by Professor WM. P. WILSON, Sc. D. Director of the Philadelphia Museums.

"The Manufacture and Export Trade of Cotton Goods," by Mr. ARTHUR PARKINSON, 13 Gold street, New York City.

"Imports of Cotton Goods," was read by Mr. FRANK P. BENNETT, of Boston, Mass., discussed by Mr. EDWARD ATKINSON.

"Progress in Cotton Manufacturing in Russia," by Mr. VLADIMIR P. POLEVOY, 120 Broadway, New York City, discussed by Mr. EDWARD ATKINSON.

"The Growth of the Modern Factory System," by Mr. ALFRED M. GOODALE, of Boston, Mass.

"The Cotton Yarn Preparation Department of the Lowell Textile School," was the subject of a paper by Mr. CHANNING WHITAKER, of Lowell, Mass.

The close of the session was devoted to an inspection of the Philadelphia Museums under the guidance of Professor WILLIAM P. WILSON, the Director.

The PRESIDENT. I take this time now to give Mr. TOMPKINS a moment on a subject that may interest you.

Mr. D. A. TOMPKINS. Mr. President, I have been requested by Mr. E. ST. JOHN, President of the Seaboard Air Line Railway, in the South, to extend an invitation to a party of 20 or 30 members of this Association, to make a trip over the road. I may say that I think that this invitation and the one also extended by the Southern and the West Point roads are probably more advisedly extended to this Association than we would ordinarily think from simply receiving the casual invitation.

Those people believe that the resources of the South, the opportunities for business and for capital, are sufficient; that if they can exhibit them to those people who are situated — as most of you in New England are, in overcrowded sections and with scant opportunities — if they can once exhibit the opportunities of that country it will gain largely in population and in capital going there to seek investment. In the early days of railroad building Mr. ROBERT Y. HAINES, of Charleston, in making a speech said: "I know of nothing excepting the Christian religion, which can be compared to the influence of a free social and commercial intercourse for removing prejudices, softening asperities, extending knowledge and promoting human happiness". We believe that in the line of this sentiment, if we can bring about such a social and commercial intercourse between the people of the south side of this Atlantic coast and the northern side, who are together interested in the development of the cotton spinning and weaving industry of this country, that we will probably reach a spirit of co-operation in which, ultimately, we will declare the commercial independence of the United States from foreign nations, as in this city, more than a century and a quarter ago, the political independence was de-

clared by the same people. I doubt whether this is the most appropriate time to undertake to make such a trip as that myself (this is my own individual opinion); I think these roads would cheerfully extend further invitations later in the season; and I believe, with some little preparation in the South and some little notice along the lines of the roads, you would have better opportunities to observe and have a better time. If the party that Mr. ST. JOHN proposes to entertain, is not made up at this meeting, I shall advise him to renew the invitation in the latter part of the winter, and I believe the Southern Railway will do the same thing. This invitation is not interfering with the Atlanta and West Point Railway, but co-operating. The members of the two different parties, whichever route they take, will no doubt receive the courtesies of the road to whatever point they may want to go from their party in the other direction. The Seaboard Excursion will start from Portsmouth, Va., in two private cars and a Pullman car; and I think that Mr. ST. JOHN would be very much pleased to have them accept, and I hope that part of you will go over both roads.

The PRESIDENT. I have the pleasure to present to you Dr. MCADEN of Charlotte, N. C., President of the Southern Textile Manufacturers' Association.

Dr. J. H. MCADEN. Gentlemen of the Convention, I thank you for the honor, and as President of the Southern Textile Manufacturers' Association, we offer you our grateful consideration. We are with you and we are of you. We are in one great enterprise together, our interests are identical. We are one people, one country, and one place. [Applause.] We are here, gentlemen, representing a distinct organization, but whose interests are identical with those of yours. We are struggling for a fair dividend upon our capital, liberal wages for our employees and a sufficient surplus fund to keep our plant and machinery up in touch with the progress of the age. That is all we ask and we certainly ought to earn that. I can say to

the New England Cotton Manufacturers' Association that we are here with you in sentiment and in unity. We are with you in a laudable emulation and an honorable competition — New England against Old England. May you win the prize. [Applause.]

The following members of the Southern Textile Manufacturers' Association attended the meeting as guests by invitation of the Board of Government:

Dr. J. H. McADEN, *President*,	Charlotte, N. C.
D. A. TOMPKINS, *Chairman of Board of Government*,	Charlotte, N. C.
J. D. TURNER, *Treasurer*,	Atlanta, Ga.
T. H. MARTIN, *Secretary*,	Atlanta, Ga.
S. BRYANT,	Randleman, N. C.
R. E. GREEN,	Gainesville, Ga.
M. T. JORDAN,	Mountain Island, N. C.
GEORGE A. MEBANE,	Asheville, N. C.
WILLIAM H. MICOU, Jr.,	Montgomery, Ala.
PAUL J. MORRIS,	Henderson, Ky.
C. K. OLIVER,	Columbia, S. C.
R. S. REINHARDT,	Lincolnton, N. C.
W. R. TUTTLE,	Knoxville, Tenn.
B. S. WALKER,	Monroe, Ga.
HAL M. WORTH,	Worthville, N. C.

SIXTH SESSION.

PHILADELPHIA TEXTILE SCHOOL, WEDNESDAY, OCTOBER 28, 1897, AT 8 P. M.

Meeting called to order, President RUSSELL W. EATON in the chair.

Mr. C. J. H. WOODBURY. Mr. President, it is a matter of general remark as to the wonderful harmony of this meeting and the unanimity of cordial feeling, but there is one element in it which alone can be said to be competitive in every respect, that is the emulation of the members to have an opportunity of expressing their feelings of gratitude and respect for the wonderful hospitality which has been lavished upon us with such taste and skill. It was but natural that when I found that I was to have an opportunity to take some part in the proceedings that I made selection of what appeared to me the best without disparagement to others, and therefore desire the privilege of offering, *Resolved:* That we tender to Mr. MERRILL A. FURBUSH and his associates of the Entertainment Committee, our thanks in the highest appreciation of the graceful hospitality which is drawing to a close, and the history of these two days will be woven in a garland of pleasant memories.

Mr. IRA J. MARTIN. In my native State of Connecticut the ability of a Philadelphia lawyer has always been a household

word, but if I were possessed of the ability of the ablest of them I should be unable to express the gratitude I feel for the magnificent entertainment we have received at the hands of this Philadelphia Committee. I have always been told that Philadelphia was *the city* and had loved it, but tonight I feel that of Philadelphia the half has never been told, and beg to offer the following: *Resolved*, That we are deeply indebted to the Pennsylvania Museums and School of Industrial Art for courtesies extended and the use of their auditorium and building; and that we extend our hearty thanks to them for these privileges.

Mr. ARTHUR H. LOWE. Mr. President, I would like to add somewhat to the motion which has been made. We have been royally entertained by the Textile School. We have been afforded every facility and given an audience and an opportunity to see the school in its operation; and, believing it is one of the most important adjuncts to our industry, I would like to add to the resolution which has been presented, the following: *Resolved*, That this Association has studied with the greatest interest the work of the Pennsylvania Museums and School of Industrial Art, including that of the Philadelphia Textile School, and desires to record in this way its highest appreciation of the important service which this institution is rendering to the cause of American industrial development. We feel that among the agencies which it is the worthiest aim of such associations as ours to promote and support, industrial education is of the first importance, and we warmly commend the spirit in which this magnificent school is conducted and the methods which characterize its teaching. *Resolved*, That no better use can be made of public funds, private munificence or of the power that results from association than the most liberal support of such institutions as the Pennsylvania Museums and School of Industrial Art.

Mr. CHRISTOPHER P. BROOKS. Mr. President and gentlemen, it is my duty, very pleasant duty indeed, to second the motion which Mr. LOWE has so ably proposed, that the best thanks of

this meeting be tendered to the Philadelphia Textile School for the courtesies they have shown to us and the exhibition they have so kindly organized for us. It would be invidious for me to name any particular one in connection with the school, as every one has labored so heartily for our pleasure and to make our visit pleasant and profitable for us, not only the trustees, the principal, the directors, but members of the educational staff, members of the administrative staff and even the students and all have helped in making it of very great benefit to us. Perhaps I can appreciate these efforts as no one else in the room can, except, possibly, Director FRANCE, who at this particular time is a very busy man indeed, for the members of the staff in their daily work are just now putting in motion the educational machine that has to run a year, arranging the schedule of studies, arranging the classes and numerous other details, they have an immense amount of work on their hands; in the ordinary course of their profession their work is enormous; and yet they have thought out and have arranged for our pleasure, this visit, carefully considering every detail beforehand and shown their tact in all the arrangements they have made for our pleasure. As a member of the Association said to me today, "Philadelphia knows how to entertain and has exceeded all she knows how to do", and certainly the Philadelphia Textile School of this city has accomplished good work and added lustre to their fame in this respect.

The SECRETARY. I have received a communication from the lady guests of the New England Cotton Manufacturers' Association, as follows: "The thanks of the lady guests of the New England Cotton Manufacturers' Association are hereby extended to Miss MARGARET M. CORLIES, President of the Sedgley Club for her courtesy for the tea on the afternoon of Wednesday, October 27th, on the occasion of their drive through Fairmount Park".

Mr. ARTHUR H. LOWE. I would like to submit the following: Mr. President and gentlemen, I think we all appreciate what the ladies have done in their efforts to please the visiting ladies, and as there are no lady members of our society, it has occurred to me it might be proper for us to express for them, *Resolved*, That our most hearty and cordial thanks be extended to the ladies of Philadelphia who have taken any part in the reception and entertainment of the ladies of the New England Cotton Manufacturers' Association, and I would further move that the Secretary be requested to forward a copy of this vote to the members of the Associate Committee of women bearing the names of all the visiting ladies and that it be prepared in souvenir form.

Mr. JUSTIN A. WARE. I move that the sincere thanks of the New England Cotton Manufacturers' Association be extended to the Franklin Institute of Philadelphia for their cordial courtesy in inviting the members and their guests to visit the Institute, and examine their extremely valuable library, models, and articles of precious historic interest.

Mr. CHANNING WHITAKER. *Resolved*, That no more homelike or attractive courtesy has been extended to us and to our ladies than the privileges of the delightful house of the Art Club of Philadelphia, where our lady guests are being entertained tonight, and the heartiest thanks of this Association be now extended to this club.

Mr. EDWARD W. THOMAS. The Philadelphia Museums are conferring a benefit upon the whole country by their broad policy in the development of markets for American manufactures, and we recognize the skill and enterprise which they have exercised in the administration of this great work. As recepients of their courtesy in the opportunity to visit their museums and the privilege of holding one session of this meeting in their auditorium, we tender to the officers of the Philadelphia Muse-

ums the thanks of the New England Cotton Manufacturers' Association.

Mr. GEORGE OTIS DRAPER. The lavish hospitality tendered our organization in this good city calls for more than a general recognition. Among those whose consideration has won our gratitude, the Philadelphia Bourse is prominently remembered; and it is hereby *Resolved*, That the New England Cotton Manufacturers' Association return their sincere thanks for the courtesies proffered by the Philadelphia Bourse during the inspection of their interesting exhibition, and for the compliment of the special medal struck in our honor.

Mr. THOMAS G. COX. I would like to move a vote of thanks be given to the Manufacturers' Club of Philadelphia, and I make the following resolution: *Resolved*, That the thanks of the New England Cotton Manufacturers' Association be extended for the entertainment, and other courtesies extended to our Association, all of which has tended so materially to make our stay in Philadelphia pleasant, and I move that the Secretary be instructed to forward to the secretary of that association a copy of this resolution.

Mr. CHARLES K. OLIVER. Mr. President and members of the New England Cotton Manufacturers' Association, I wish to make the following resolution: *Resolved*, That the thanks of this Association be given to the Hon. THEODORE C. SEARCH, President of the National Association of Manufacturers, for his able and exhaustive address delivered at the opening session of this meeting.

Mr. JOHN TEMPEST MEATS. I wish to offer the following: *Resolved*, That the New England Cotton Manufacturers' Association extends to the Western Union Telegraph Company its high appreciation of the great courtesy which has been extended in the free use of its service during this convention, and to re-

turn to the officers of that company our warmest thanks for the unwonted privilege which they have so kindly conferred.

Mr. FRANK P. BENNETT. In addition to the resolutions which have been offered in regard to the organizations which have deluged us with hospitality, I would like to offer the following resolution: *Resolved*, That this Association extend to the Postal Telegraph Company its thanks for the kindness of that company in granting us the free use of their line during our stay in Philadelphia.

Mr. L. C. FARNSWORTH. Mr. President, one of the favors which we appreciate and the facilities in which the New England cotton manufacturers have participated are those extended to us by the American Telephone and Telegraph Company, for which on behalf of the Association, I would offer this resolution of thanks: *Resolved*, That in thanking the American Telephone and Telegraph Company for the privilege of their lines during this meeting, we also desire to express our appreciation as business men of the importance of the long-distance telephone in the conduct of our affairs whose scope is enlarged through their excellent service.

Mr. WINTHROP THAYER. That we are in the city of brotherly love; that we are bewildered by the kind attention lavished on us; and that we are unable to sufficiently express our appreciation, are all self-evident truths; and to register a simple vote of thanks seems too insignificant an expression. Yet we hope our good friends will understand the depth of our feeling underlying these simple words. So I do make a motion that our thanks be given to the Upper Delaware River Transportation Company for the charming sail in the steamer "Columbia", on the Delaware River from League Island to Messrs. CRAMPS' shipyard; and also we join in the hope that League Island Navy Yard will soon be the site of a much needed modern dry dock. That the 1st Regiment Band welcomed the Association on board most

appropriately to the march of "King Cotton", and that they then, inspired by "El Capitan", enthused the attack, and complete annihilation of the appetizing collation proved to the delighted guests that they were quite equal to the occasion. Our thanks for the whole excursion are most heartfelt and spontaneous.

Mr. J. O. SWEET. I desire to offer the thanks of the Association for the hospitality of the Messrs. Wm. Cramp & Sons, and the valued privilege of visiting their shipyard and viewing the great establishment.

Mr. FRED. C. MCDUFFIE. I desire to avail myself of the opportunity of offering the thanks of this Association to the Baldwin Locomotive Works for the opportunity of visiting their establishment.

Mr. CHARLES K. OLIVER. *Resolved*, That the thanks of the New England manufacturers be expressed to the Bell Telephone Company of Philadelphia for its courtesy and hospitality to the members of the Association in the free use of its lines and services, which has been so generously tendered them during their stay in the city.

Mr. H. G. BRINCKERHOFF. I desire to present the following: *Resolved*, That the thanks of the New England Cotton Manufacturers' Association are tendered to the Southern Railway Company for affording the members an opportunity to take an extended trip over their lines which extend among the textile manufacturing districts of the South.

Mr. STEPHEN N. BOURNE. *Resolved*, That the thanks of this Association are presented to the Seaboard Air Line Railway for the courtesies of their road offered to those in attendance at this meeting.

Mr. JAMES A. WALSH. *Resolved*, That the New England Cotton Manufacturers' Association tenders to the Atlanta and

West Point Railway Company their thanks for the courtesy of their lines offered to this Association, after this meeting.

Mr. CHARLES L. BAILEY. I move that the thanks of the Association be tendered to His Honor CHARLES F. WARWICK, Mayor of Philadelphia, for his cultured and eloquent address of welcome which graced the occasion of holding our sixty-third meeting in Philadelphia.

The PRESIDENT. You have heard the resolutions presented by various members of the Association, what is your pleasure?

Mr. J. H. KENDRICK. I move the adoption of these resolutions.

Resolution carried unanimously by a rising vote.

Mr. CHARLES HEBER CLARK of Philadelphia, spoke upon "Philadelphia as a Textile Manufacturing Centre", after which the following papers were presented:

"Comparative Life of Cotton Machinery," Mr. EDWARD W. THOMAS, Lowell, Mass.; "Repair Shops," Mr. FRANK M. MESSENGER, North Grosvenor Dale, Conn.; "Mill Repair Shops," Mr. D. D. DONOVAN, Providence, R. I.; "The Proper Construction and Uses of Economizers," Mr. HENRY G. BRINCKERHOFF, Boston, Mass.; "Some Vital Points Concerning Fire Protection of Mill Property," Mr. WILLIAM H. STRATTON, Hartford, Conn.

Topical question No. 87, "What is the maximum length to put No. 100s on bobbin"? No discussion.

Topical question No. 90, "Do you consider it practical to spool No. 120s yarn with the Wade bobbin holder?" Discussed by Mr. JOHN ECCLES.

Voted to adjourn.

Adjourned.

Attest:

C. J. H. WOODBURY,
Secretary.

THE SOUTHERN EXCURSION.

After the meeting the following persons entered upon a trip over the lines of the Southern Railway:

R. W. EATON, *President of the Asso.*,	Brunswick, Me.
JOSEPH D. AIKEN,	Taftville, Conn.
A. E. ADAMS,	Whitinsville, Mass.
JAMES H. BILLINGTON,	Philadelphia, Pa.
HENRY G. BRINCKERHOFF,	Boston, Mass.
FRANK B. COMINS,	Providence, R. I.
H. H. CULVER,	Taunton, Mass.
CHARLES H. GORTON,	Woonsocket, R. I.
H. P. GARLAND,	Biddeford, Me.
J. O. HANNUM,	Victory Mills, N. Y.
R. R. KELLEY,	Williamstown, Mass.
CHARLES MCLEOD,	Philadelphia, Pa.
IRA J. MARTIN,	Bozrahville, Conn.
WILLIAM R. NOONE,	Camden, Me.
J. W. PEAD,	Lowell, Mass.
M. W. QUINN,	Amesbury, Mass.
E. H. SAMPSON,	New York, N. Y.
C. H. TRUESDELL,	Killingly, Conn.
O. B. TRUESDELL.	Fiskdale, Mass.
A. S. WATTLES,	Canton Junction, Mass.

The ladies accompanying the party were:

Mrs. RUSSELL W. EATON,	Brunswick, Me.
Mrs. H. P. GARLAND,	Biddeford, Me.
Mrs. J. O. HANNUM,	Victory Mills, N. Y.
Mrs. ROLAND R. KELLEY,	Williamstown, Mass.

The party left Washington at 10.43 P. M., Friday, October 29, in charge of A. L. LANGELLIER, agent in Boston of the Land and Industrial Department of the Southern Railway, and were also accompanied part of the time by M. N. RICHARDS, Land and Industrial Department, Southern Railway; J. H. DRAKE, Assistant General Freight Agent, Southern Railway in Richmond, Va.; H. J. O'BRIEN, Division Superintendent, Southern Railway; D. A. TOMPKINS, Charlotte, N. C.; C. K. OLIVER, Treasurer Columbia Mills, Columbia, S. C.; S. I. ROBERTS, Manager Riverside Mills, Danville, Va.; W. B. SMITH-WHALEY, Granby Mills, Columbia, S. C.; and L. W. CLARK, Greensboro, N. C.

The party occupied two Pullman cars and the train was run as special most of the time.

Saturday, October 30, the Riverside Mills, Danville, Va., were visited and drives taken over the city. Most of the ladies visited the immense tobacco warehouses, watching the auction sales and listening to the darkies' plantation songs.

The Edna Cotton Mills at Reidsville, N. C., were visited. The party reached Salisbury, N. C., at 5 P. M., visited Salisbury Mills, and were entertained by Mayor LINN and citizens.

Sunday, October 31, was spent at Asheville, N. C., and devoted to drives in the vicinity.

Monday, November 1, visited Spartan Mills and Pacolet Mills at Pacolet; thence visited the Union Cotton Mills at Union, S. C. The party were met at Pacolet by a delegation from Columbia, S. C., and on arrival there they were entertained by the citizens of Columbia.

Tuesday, November 2, was spent in Columbia, visiting mills and water power plants, the city, etc. The evening was spent in speech making and entertainment by Columbia Club.

Wednesday, November 3, Greenville, S. C. Forenoon was spent in Greenville visiting mills and driving about the city; visited Clifton, Gaffney's, Blacksburg, S. C., Kings Mountain and Gastonia, N. C., arriving at Charlotte, N. C., 6 P. M., where the party was entertained by the Manufacturers' Club.

Thursday, November 4, was spent visiting mills and taking drives around Charlotte. At 10 P. M., eighteen or twenty went back North via Washington; several of those that remained went to Augusta, Columbia, Asheville and other points. The excursion was completed without delay or mishap of any nature.

TRANSACTIONS.

FIRST SESSION.

THE AUDITORIUM OF THE PHILADELPHIA TEXTILE SCHOOL, OCTOBER 27, 1897.

The meeting was called to order at 9.30 A. M., President RUSSELL W. EATON in the chair.

The PRESIDENT. At the opening of this, the sixty-third meeting of the Association, I wish to congratulate the members upon its healthy condition. It now numbers upon its rolls over 500 members, honorary, active and associate; and though it would be well to have this number largely increased, yet as long as the present members cheerfully aid in the work, the aims of the Association can be attained to a fair degree. Our Association is not one that contains representatives, necessarily, of mill owners, although many such are among our members. It is not a gathering of mill laborers, although many of our members began their mill experience at the card, mule or loom. But, distinctively, our members are engaged in the direction of the mechanical affairs of cotton mills; and it is this common occupation that welds us together. A member may be a treasurer, agent or superintendent of a mill; but it is that he directs or controls the mechanical affairs of a cotton mill that makes him interested in the work of this Association. We believe that this avocation is a high one; that upon the proper

ADDRESS OF HON. CHARLES F. WARWICK,

Mayor of Philadelphia.

Mr. Chairman, ladies and gentlemen, when I received the invitation to attend these opening ceremonies and to extend the hospitality of the city to our visiting friends, I was much pleased. Having some Yankee blood in my veins it gave me especial pleasure to greet the representatives coming from New England.

It is remarkable what good blood you find in so many good men all over the country, coming directly from New England, and it is worthy of mention that most of it gathers in Philadelphia.

I greet you most heartily, and we hope that in this manufacturing centre, the union of our efforts with yours, will improve in every way the work that falls within your line of industry.

I see that you have for discussion under one of your topical questions, "The Improvement of the Mule". I am glad you are going to consider that question, for we have a good many in this city: men who propose nothing and oppose everything; men who have all the features and the characteristics of that animal with the long ears and the long hind legs, and if you can only, in your deliberations, devise some means to improve this animal, your convention will not be in vain.

And don't stop, I pray you, at our city; you will find them everywhere, and the older the world grows the more obstinate they become and the faster we go the harder they pull back.

In looking over your programme I find that you are to consider the matter of "yarn preparation". I hope you will refer the result of your deliberations to the newspaper fraternity and to the politicians generally.

While at the reception last night, I heard a young lady say to a New England representative, "Why, you are not a cotton but a yarn spinner". I didn't interrupt that conversation but passed by in silence. [Applause and laughter.] These New Englanders when they get away from home sometimes forget their vocations.

I hope that you will upon acquaintance be pleased with our city and learn to love her as we do.

We believe that Philadelphia is essentially the American city on this continent, and when you leave us we hope you will desire to return; our welcome is always so cordial and our hospitality so generous, that most strangers are loath to leave us (unless one has committed an offense against the law), and I want to say in this connection that our police bureau is very alert.

This Museum in which we have met is one of the most useful institutions in our city, and should be generously fostered and sustained. Its purpose is to make the fine arts a hand-maid to the industrial arts. To weave into the web and woof of every-day fabrics, artistic designs, rich and harmonious in color.

The principles of the fine arts as we understand them can be applied and hereafter will be applied to the practical wants and the every-day uses of life. The humblest fabric worn should please the eye in design and color.

I have often thought that perhaps the time will never come when we will again have in this world an epoch as distinctive in its art features, as that of the renaissance.

We have reached what may be termed the practical age, in the history of the world. We have not the child-like faith and the religious fervor of the past. There must be back of such an era as that referred to above, a frenzy, an enthusiasm, an awakening of the soul. Man must feel intensely and yield to an overpowering sentiment that finds expression in the forms of art. To produce such an era there must be a spirit of devotion to some great purpose.

If you will study the history of the past you will find that art has been developed under such conditions. Go into the East,

the great architectural works were erected under the influence of religious zeal and fervor. Temples were dedicated to the gods and but expressed a devotion to religion.

Go to Athens — the Parthenon in all its glory is but an expression in architecture, of love and devotion to Minerva, the patron goddess of the city, and the beauty of that structure in its simplicity is but the expression of that devotion.

The gothic cathedrals of the middle ages, with their flying buttresses, with every part so delicately adjusted that they seem ready to collapse, yet have withstood and will withstand the shock of ages, are but an exponent of the intense devotion to God and to religion. They sprang into being as if under inspiration, and it is through these temples that man expresses his thought and shows his love for the infinite.

The Venus de Milo and the Madonna di San Sisto, one in marble, the other on canvas, express the same sentiment in different ages.

We may never have a Periclean, an Augustan or a Medicean age; we have, as I have already said, grown too practical. The world is rather intellectual than sentimental. In the past they devoted art to their temples and public buildings; today we are applying the arts to our practical industrial life.

These textile schools are doing much in this direction. They are furnishing you with designs which you will weave into fabrics, and there is no reason why we should not, in this country, compete with the Orient.

In time we may surpass even the Turkish rug and the India carpet; our designs will be more beautiful and our dyes as brilliant and as lasting; and with our ingenuity we may vie with the East in the manufacture of those fabrics that are said to be as fine as a "famished spider's web".

I hope that this convention will urge you to greater effort and that the lessons you learn within the walls of this institution may find their way into your work.

I came here simply to express my gratitude at your coming and to welcome you to the hospitality of the city. I fear that

you will think I have trespassed upon your time in an effort to make a speech.

That you may have a pleasant and instructive visit and carry away happy recollections of your hosts is my earnest wish.

[Prolonged applause.]

The PRESIDENT. Gentlemen, I wish to introduce to you Mr. THEODORE C. SEARCH, President of the National Association of Manufacturers. [Applause.]

Mr. THEODORE C. SEARCH. Mr. President and gentlemen, and members of the New England Cotton Manufacturers' Association, before I begin my speech I am requested by the Entertainment Committee, with which you perceive by my badge I have some considerable relations, to state that it is very important for the work of that committee and for your comfort that the guests and members of your Association should register, in order that they may have the names.

Sometime ago I was invited through your President to make some remarks on this occasion and in that way to represent the National Association of Manufacturers. This it shall be my pleasure to try to do; but as many of you know of my long connection with this institution, you may expect from me some words concerning it. These shall be very few indeed, and I propose to say them just now. I shall leave that work mainly to the addresses of the principals of the school who are to follow, as I understand from the programme. I only want to say that as I grow older in the work and gain greater experience in it, that I gain greater faith in it, and I notice from the reports that have come to this country within the last few days that the commission appointed by England to try and examine into the causes of England's retrogression in regard to certain manufac-

tures, they have returned from their duties and made their report. It is not entirely public as yet, but as I understand, the important fact is that England is not doing her full duty in the formation of schools of this character; and as a result the work of England is falling behind and she is retrograding, and we think this report is going to impress upon the English nation the great necessity that exists for them to extend their work in the support of these schools, so that England shall have the advantages that are now enjoyed in a larger measure by France and Germany. As a nation we have but little to show in comparison with the work that is shown abroad, but such as it is — either here or in New England — we fancy and believe that we have as good representatives as can be found anywhere in the world; the only thing we need, gentlemen, is more of them and larger and heartier support from the people at large. [Applause.]

Trying to think over what would be interesting to the cotton manufacturers of this country, it occurred to me in my thoughts with reference to foreign trade, that the plethoric condition of our markets, especially in cotton goods, which prevails from time to time (and I might almost say periodically) might be very considerably improved if the manufacturers and merchants of this country would take such steps as would lead to the opening of a large foreign trade; and with this in my mind, I have prepared a few words upon that subject which I will now submit to you.

AMERICAN COTTON GOODS ABROAD.

Your programme shows that the subject of foreign trade in American cotton goods will occupy a considerable share of your attention during this meeting, and as the technical features of this subject will be quite fully discussed in other papers, I will limit my remarks to an endeavor to show briefly the great importance of the development of a large export trade in the products of our cotton mills. The cotton goods trade of the world is practically in the hands of four countries, whose exports can be stated thus:

Great Britain (1896)	$332,331,000
Germany (1895)	47,742,000
France (1895)	28,757,000
United States (1896)	19,840,000
	$428,670,000

What presents itself most strikingly in these figures is the enormous extent of Great Britain's foreign trade in cotton goods, and the insignificance, by comparison, of the export trade of the United States in this line. Great Britain, without a pound of native raw cotton, spins and weaves over 77 per cent. of the cotton goods that are purchased by other nations. The United States, producing over one-half of all the cotton grown in the world, supplies less than 5 per cent. of the manufactures of cotton which other countries buy. Over 95 per cent. of the world's trade in cotton goods is in the hands of Great Britain, Germany and France, neither of which raises a pound of cotton at home, and all of which are dependent upon the United States for their raw fibre. We have only the single meagre profit which is yielded by the growing of the cotton. Our European competitors earn a profit on the transportation of the cotton from our ports to their mills, on the spinning and weaving of the various products, and then there is a further gain for foreign capital in the distribution of the manufactured goods to the markets of the world — the United States included.

It is difficult to grasp the magnitude of Great Britain's export trade in cotton goods when we have only figures upon which to base our impressions. In 1896, the British spinners consumed 4,160,000 bales of cotton, and 83 per cent. of the product from this cotton was exported. Thus, the British exports of cotton goods last year represented the consumption of about 3,412,000 bales of raw cotton, or about 200,000 bales more than the entire quantity consumed by the mills in the United States during the same period.

Bearing in mind the enormous aggregate of the world's consumption of cotton goods, we may find some suggestions of

future possibilities for American trade by a glance at the principal markets where Great Britain, Germany and France and the United States dispose of their exports, leaving out of consideration the interchange of business among these four great producing nations. I have endeavored to ascertain as closely as possible the total imports of cotton manufacturers in leading countries in recent years, together with the share of Great Britain and the United States in each case.

India imports annually about $75,000,000 worth of piece goods and yarns, of which Great Britain furnishes about $70,000,000 worth, while less than $200,000 comes from the United States. Although India's own cotton industry now operates about 4,000,000 spindles, and furnishes a large quantity of goods to China and Japan, the colony is still England's largest customer, and might even afford a large market for American cotton goods if properly cultivated.

China is the next largest buyer of cotton manufactures, the annual imports amounting to about $43,000,000 gold. This is the largest foreign market for American cottons, and the only place where our manufacturers make any impressive show of strength in comparison with our competitors. Our exports of cotton cloths in China, which amounted to only $2,000,000 in 1895, increased to over $6,000,000 last year, while Great Britain's share in the trade amounts to about $18,000,000 annually.

Turkey comes next in the list of cotton purchasing countries, with annual imports of over $25,000,000, of which Great Britain supplies nearly $20,000,000. The exports of American cotton goods to Turkey are not sufficient to enter into this calculation. We send practically nothing direct.

Brazil, with a considerable supply of native cotton and textile industries that are assuming importance, is a buyer of about $20,000,000 worth of foreign cotton goods annually. England is the seller of about $13,000,000 worth of these goods, while our largest share in the business has been about $1,500,000, and is now less than $1,000,000 per annum. And this is in spite of

the fact that American brands of cotton cloths are so esteemed in Brazil, that the poorest qualities of European goods find a market there on the strength of their imitations of American marks.

The Argentine Republic imported in 1895 nearly $18,000,000 worth of cotton cloths, of which nearly $14,000,000 came from Great Britain; $1,130,000 from Germany; $532,000 from Belgium; $450,000 from France; and only about $217,000 from the United States.

The Australasian colonies of Great Britain buy annually about $15,000,000 worth of cotton goods, of which close upon $14,000,000 worth is imported from the mother country. All the manufactures of cotton sold to the colonies by the United States do not amount to $200,000 in a year.

This analysis of the distribution of the world's cotton goods might be continued much further, but it would only show upon a smaller scale the insignificance of our share in the trade, which has already been shown by the figures that have been presented. There are a dozen markets which take each about $5,000,000 worth of goods annually, and a much larger buy from that quantity down to $500,000 or less each year; and in nearly all of these, American cotton goods occupy the same position of minor importance that they hold in the greater markets. Nor have the exports of cotton goods from the United States increased in proportion to the growth of the industry, or in proportion to the increase which has taken place in the exports of some other leading commodities. In the past twenty years, the number of spindles in the United States has nearly doubled, and the product has increased in much greater proportion, but the exports of American cotton manufactures have increased only about one-half in that time. The exports of manufactured articles, as a class, have more than doubled in twenty years, but cotton goods are below the general average in this respect.

Comparing the export trade of the United States in cotton goods with that of Great Britain, Germany and France, and bearing in mind our abundance of raw material, our skill and

ingenuity in manufacture, and the remarkable growth of our great industries, one is naturally led to look for the cause of our comparatively small foreign business in cotton goods.

There are probably many reasons, but if I may be pardoned for saying so, I am inclined to believe that the lack of a larger export trade in this line is mainly the fault of our manufacturers and their selling agents, who have failed to appreciate to the full extent the possibilities of the foreign trade in cotton goods, and the importance of developing it.

If you will turn to the reports of the United States consuls, you will find frequent references to the neglect of opportunities by American manufacturers. Consuls have repeatedly pointed to the opportunities for introducing American cotton goods in important markets, and have indicated the steps necessary to bring about the desired results, but these results are not manifest in the statistics of our foreign trade. Turn also to the reports of the British consuls and you will find abundant evidence that the possibility of selling American cotton goods where British goods are now sold is appreciated on the other side of the water perhaps better than here. I believe I am within reason when I say that there is hardly a market of importance in the world, outside of Europe, where it would not be possible to develop a stable and satisfactory trade in American cotton cloths.

Naturally this invites inquiry as to the method by which this trade can be developed. Many conditions contribute to success in securing foreign trade for American manufacturers. Banking facilities, American steamship lines, quick postal communication, all help in building up our trade abroad, but with or without these aids we can get business if we will do as the English, German and French merchants do; namely, send our men out to seek trade, to study the markets and the people, and when we know what is wanted, be willing to make it and sell it as our competitors do. There is a vast amount of foreign trade in cottons which can be had if any one will go after it, but it can not be obtained in New York, in Boston or in Philadelphia.

I think we are all inclined to be a little too dictatorial in our business methods in dealing with foreign buyers, overlooking the fact that German and English merchants are eager to do business upon terms which make us hesitate. We are not always willing to be liberal in prices, terms, packing, etc., as our customers would wish, and herein lies the cause of much of our retarded development in some lines of foreign trade. Let me give you an illustration.

A few months ago a reputable merchant in the far East wrote me, as president of the National Association of Manufacturers, asking me to have sent to him some samples of American sheetings and shirtings, which he had been buying largely in England. Samples from one of the largest mills in this line were sent to him and he forwarded a trial order. His terms were not satisfactory to the selling agent of the mill who demanded cash before shipment. With some reluctance, the merchant said he would remit in advance if desired, and then the selling agents wrote that they didn't care to bother with the order, as the buyer requested that his own label should be placed on the goods in addition to that of the makers. The label was a small mark in Arabic characters, and the selling agents declared that they did not understand the label and didn't believe anybody else could. So the order was declined after four months had been wasted in correspondence. The order amounted to about $2,000.

This is an extreme case, of course, but it presents in an aggravated form a difficulty which is often encountered, and which tends to obstruct the growth of our foreign trade, not only in cotton goods, but in other articles for which there is demand abroad. We view with suspicion and distrust foreign merchants who wish to buy our goods, while we take greater risks at home with little hesitation. We make much ado about the long credits which foreign merchants are supposed to ask, while in some lines even longer time is given to buyers in this country as a matter of course. In short, we lose much by failing to apply to our foreign trade the same common sense and

practical methods that we use in our business at home. A certain amount of foreign business can be secured by correspondence and upon such terms as we may choose to dictate; but if we are ever to develop an export trade in cotton goods, or in other lines, that shall be proportioned to our vast commercial interests at home, it must be built up by direct personal effort.

Above all things, it is needful to show the actual goods to the prospective purchaser. A display of samples under favorable conditions in a foreign market is many times more effective than the most persuasive correspondence. It is in recognition of this principle that the National Association of Manufacturers has undertaken to establish a system of sample warehouses in foreign countries, the first of which is now being opened in Caracas, Venezuela.

The cotton goods trade enjoys an advantage in the facility with which small samples can be distributed throughout the world, which can not be done with many other lines of goods. Such samples are scattered in abundance by British manufacturers and a great many of them are sent to the National Association of Manufacturers by its foreign representatives.

Information about the requirements of foreign markets, as to the character of the goods wanted, the styles, prices, methods of packing, etc., is not difficult to obtain. Much of this information is being offered continually from numerous sources, but foreign buyers are not so well supplied with particulars about the goods which our manufacturers have to sell.

It is hardly possible to estimate the advantage that would follow the development of an export trade in cotton goods in its fullest possibilities. Nor is it possible to indicate the limits of our achievements in this line. We have been able to compete successfully with Great Britain in many branches of industry which once were regarded as beyond our reach. Twenty years ago the thought of rivaling Great Britain in the manufacture of iron and steel was hardly entertained, but for seven years we have led the world in this industry, and are now send-

ing pig iron, steel billets and steel rails into the heart of England.

The beginnings of the cotton manufacturing industries in the United States were viewed almost with ridicule by the British manufacturers, who declared that the spinning and weaving of cotton would never amount to much in the United States, but today we have about 17,300,000 spindles, and while we are adding to this number at the rate of 100,000 to 800,000 per year, Great Britain's cotton spindles are now decreasing in number year by year, about 3,000,000 having been put out of work during the past five years. British supremacy in the cotton goods trade is no longer unquestioned, and nowhere is this fact so well recognized as in England. In view of what American skill, enterprise and energy have accomplished in other industries, shall we be regarded as visionary if we entertain the hope that a large portion of Great Britain's vast export commerce in the cotton trade shall be ours?

Just a word, now, as to the benefits to be derived from the broadening of the foreign markets for our cotton manufactures. If we add a million dollars to our exports of cotton cloths, there is a positive gain to the country of just that amount, which can be expended for the products of our various industries. The cotton planter, the mill owner, the factory operative, the machinery builder and the supply man each receive a share, and nothing is withdrawn from any other industry. The extension of our foreign trade in cotton goods would not only relieve the home market of an embarrassing surplus of goods, but would dispose of the product of many new mills, give employment to thousands of additional hands, and add to the business of the many branches of industry which depend upon the manufacture of cotton.

The rapid development of the manufacture of cotton goods in the South has created new problems which must be solved, and the home market is not able to absorb the output of the old and new mills. There is no doubt in my mind that the foreign markets will not only take all our surplus, but also afford an opportunity for the further expansion of the industry.

I believe that the most important matter which calls for the consideration of the cotton mill owners of the United States at the present time is the expansion of the export trade in their products.

The PRESIDENT. Gentlemen, these words are from a man who knows what he is talking about. Remember them carefully, treasure them, and when we get home whatever benefit our companies can derive from them, they should have. It is as lately as 1892 that I remember Mr. EDWARD ATKINSON predicting at the meeting of the Textile Club in Boston, it would be only a few years before America would be furnishing England with iron; and it excited not applause but smiles — nothing but smiles at the time. What little export we have now we were forced into by being starved to it. The recurrence of the periods of hard times may open our eyes to what we are able to do; and when we run our mills 20, 40, or 90 per cent. of the time, we may think it advisable to run them 100 per cent. of the time and give the export trade of this country the benefit. One of the things that will enable the United States to compete in the markets of the world as much as anything will be the improvement of the artistic in textile designing. And it very appropriately comes in at this stage of the meeting, and I shall call on Mr. EDWARD W. FRANCE, the Director of the Philadelphia Textile School to address us now.

THE IMPORTANCE OF THE ARTISTIC ELEMENT IN TEXTILE EDUCATION.

EDWARD W. FRANCE, Director Philadelphia Textile School.

The importance of a careful training in the technical processes of the textile industry is, I am glad to say, beginning to be realized in this country, although the extent to which this is true is by no means commensurate with the immense interest at stake. As a nation we have spent many years in the development of ideas tending toward the improvement of our textile machinery. Much attention has been given to the process of spinning; in perfecting swiftly moving spindles; in bringing out cards which will handle the fibre carefully and at the same time speedily. The loom has also received much attention from inventive genius, and has perhaps been developed to a higher degree than even the carding and spinning machinery. Looms have been built so perfect that while running at a high rate of speed they are yet so automatic as to be "self-feeding", "self-stopping" and self-adjusting", and to require a minimum of attendance; and so on through all the various steps of manufacturing from the raw stock to the finished goods. The aim has been more production, more yardage, more saving of labor, and this aim has been attained.

If necessity is the mother of invention, competition is the ever sleepless agent which has caused us to devise all sorts of economic plans to increase the output of our mills and to minimize the number of hands employed. In the words of S. N. D. NORTH in an address at a recent commencement of our school, "the effect of this machinery is to minimize the relative importance of the individual who becomes the mere machine tender,

and to enhance the usefulness and the value of the individual factor on the other side of the line. The mere machine tender is a person less dependent, less favored, in his direct relationship to industry than the hard worker of the seventeenth century; he has become little more than a human wheel in the system of machinery he operates. Perfectly true it is that we cannot all be captains of industry; that the great mass must remain in the rank and file; that the machine tenders must relatively increase in number. Equally true is it that if the development of the machine reduces the skill and ability required in some departments of manufacture, it increases them in others."

Up to the present time we have, thanks to the development of our mechanical appliances, been enabled to meet foreign competition in many lines of production, but it is needless to deny or to attempt to persuade ourselves to the contrary, the day of reckoning has arrived; we are on the threshold of the closest kind of competition with men who have the advantage of us in many ways and in many lines of textiles. The foreigner has all our economic appliances, and he has also the skilled craftsmen trained in the artistic branches which we have systematically neglected. He has watched our wonderful mechanical progress and he has set himself to surpass us on other, and perhaps more profitable, lines. After a little careful study it was apparent that quality rather than quantity was, after all, the chief factor in the problem, and to attain success in this direction, it was recognized as indispensable that not only the working classes but the manufacturers as well must be educated to higher and finer standards of taste than ever before.

Europe recognized long ago the supreme importance of educating its people in the technical details of their vocations, and this has especially been true of textiles. Many schools have been established by the different governments for the diffusion of knowledge in relation to this important branch of manufacture, and the claim that Germany's supremacy in manufacturing is mainly due to her generous provision for systematic education of this kind, is heard on every hand and is generally

accepted as perfectly established. The lesson for American manufacturers is therefore very plain. If we expect to win our way to the highest kind of success in textile production, we must build better in the years to come than we have built in the past; we should begin by making provisions for industrial art and technical instruction in connection with the grammar grades. It is idle to talk about what we have accomplished without this kind of education, and to compare ourselves with others who have it. The thing to think about is not what we are, or have been, or have done without it, but what we would have been and what we may accomplish with this aid. Supplement an adequate protective tariff with textile training schools, with industrial art and technical schools, and not only our own but a big share of the world's markets must open their gates to our goods. It is the nation which possesses the most skill which will win in the race. The country which expects or deserves to make fabrics which will find a ready sale in the markets of the world, must see that her citizens engaged in the manufacture of such goods not only possess a knowledge of the minutest details of the operations, but that they also have in addition to this a training which will supply that refining influence of culture and taste which is essential to all high-class production.

The truth that needs to be brought home to those who are looking to technical education for the solution of the industrial problems which press the hardest upon us, is the fact that culture, and that of the most thorough kind, is not to be dispensed with, but directed. It is unfortunately rather easy to believe that it can be dispensed with; that our boys need not go to college at all, because so many that have gone have failed to make profitable use of the things they learned. If people draw such conclusions as that, they make a great mistake. The college and the high school were never so necessary as now, and the necessity of them is increasing and is to increase indefinately as the years go by. The demand for culture of the most thorough kind was never so great as it is at this moment, and it was never demanded so persistently as it is by the industrial

classes in whose interest this great movement for technical education is going on. It is not less cultivation then, but more, that we are after, and the business of the technical school is not to withhold it, but to increase and multiply, under proper direction, the forces that make for culture and refinement. The need of this manifests itself in various ways. On the side of science the lessons are obvious and do not need to be insisted upon here. However definite and specific the aim of the future manufacturer may be, it is a truism that his success will depend upon the amount of knowledge which he is enabled to carry from the school into his business. No amount of definiteness can compensate for the want of thoroughness; no amount of specific application can possibly make up for neglected development.

The industries of the world are rapidly being transformed by the revolutions wrought by science and the development of scientific processes. The old methods of doing things are rapidly giving place to new ones which the laboratory of the chemist and of the mechanician have developed, and the road to success in any branch of economic production lies through the portal to which science holds the key. If I do not insist at greater length on this principle in this place, it is because the truth is so generally recognized already. It is apparent, however, that in one other direction the real requirements of the case do not seem to be so well understood and seem to demand our serious attention and most earnest advocacy.

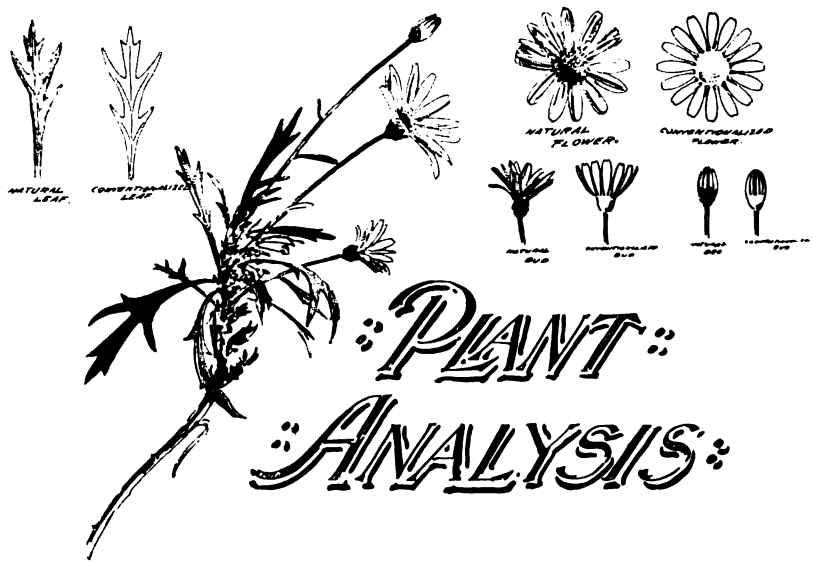
It is not, after all, on the side of science that our industrial needs are most apparent today; it is on the side of art. It is in matters of taste that we need training the most; it is the artistic element that constitutes the charm of textile productions and enables the good goods to hold the market. No amount of cheapening of processes can compensate for the absence of this quality, and no amount of merely technical education or mechanical skill can supply this want. It is time for the truth to be spoken on this head; we have been strangely backward in learning this lesson. Manufacturers and those who direct the

affairs of great establishments often excuse their own shortcomings in this regard by saying that matters of taste are no concern of theirs; that they try to understand the demands of the market and are willing and even eager to produce the ugly things as well as the beautiful if the public seemed to want them. This familiar form of argument is at once a fallacy and a confession. On the one hand the man who uses it really does not as a rule know what is good and what is bad for himself, and is in his heart more or less conscious of his own deficiency in matters of this kind, and on the other hand (and this is really a much more serious matter) the public is certainly ahead of the manufacturer in matters of taste. The product of the foreign looms has found and is finding a market in our midst, not because it is cheaper, but because it is more beautiful; and it is more beautiful not because of the employment of better machinery or more economical methods of production, but because its character is determined by a finer taste. This is the real secret of the whole business. We shall fail to command in the future, as we have failed to command in the past, the market for the higher class of goods until our workmen and designers are as tasteful as those on the other side. The infusion of this element of beauty into our products in the future means training in art for the men who are to do the work, and it cannot possibly mean anything else. It means that if his efforts are to achieve success, the student of the textile school must devote a great deal of his time to the pursuit of art; must be familiar with the principles not only of chemistry and mechanics, but of form and color; that he must be familiar with and appreciative of the essentials of grace and beauty quite as much as he is with the nature of fabrics or the efficiency of machinery, for unless he can import into his work the element of charm which only the æsthetic sense can provide, the most important part of his work has been left undone.

I know well enough how indifferent has been the success of many well meant efforts to supply the needs to which I am calling your attention. Most of us have watched with more or

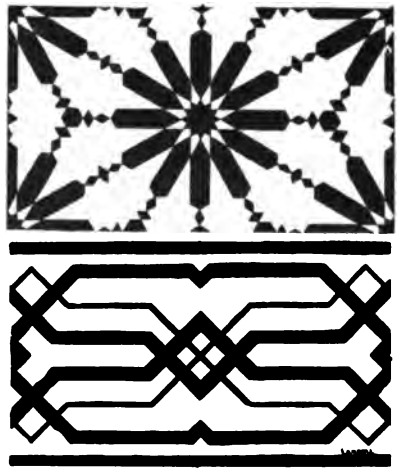
less interest the establishment of schools of art all through the country, the announcement of whose courses seemed to promise everything that was needed to set us all right in the matter, and yet after a few years of trial how disappointing the results have usually been. The reason for this disappointment is not far to seek. Earnest advocates for the art idea as the true remedy for our industrial ills have been by no means wanting, and endowments for the establishments of art schools have been made on the most liberal scale. The fundamental truth on which this effort is based, is undeniable, but the discouraging fact remains that the connection between this purely artistic effort and the actual processes of manufacture, have, for the most part, still to be made; the chasm which still yawns between art and industry has still to be bridged. The explanation of this is, I think, partly to be found in the standards which art education has set for itself, as well as in the undoubted shortcomings which characterize our technical instruction. Much remains to be done on both sides, for if the technical schools have been too mechanical in their methods, the art schools have on their part been too much occupied with things whose connection with industry has been too remote to make their influence felt, at least by the present generation of producers.

It is a standing and well deserved reproach of academic training in art that its recipients are in very great danger of losing all enthusiasm for original work of any kind, and even if this were less true of art in general than is unfortunately the case, it would still be true that the student of academic art everywhere very soon passes the point where he is likely to be of any use as an industrial designer. To be of real use, then, in shaping the minds of future designers in all such lines of work as the textile manufacturer is interested in, the course of most art schools ought to be profoundly modified in the following directions: In the first place a great deal more attention ought to be paid to the study of nature in its more decorative aspects, that is of fruits, flowers, birds, and all such simple forms of natural things as those which the mind of man instinctively turns to in



SPECIMEN SHEET OF ANALYSIS AND ADAPTATION OF NATURAL FORMS IN ORNAMENTAL DESIGN.

ADAPTATION OF HISTORIC MOTIVES IN ORIGINAL DESIGN.



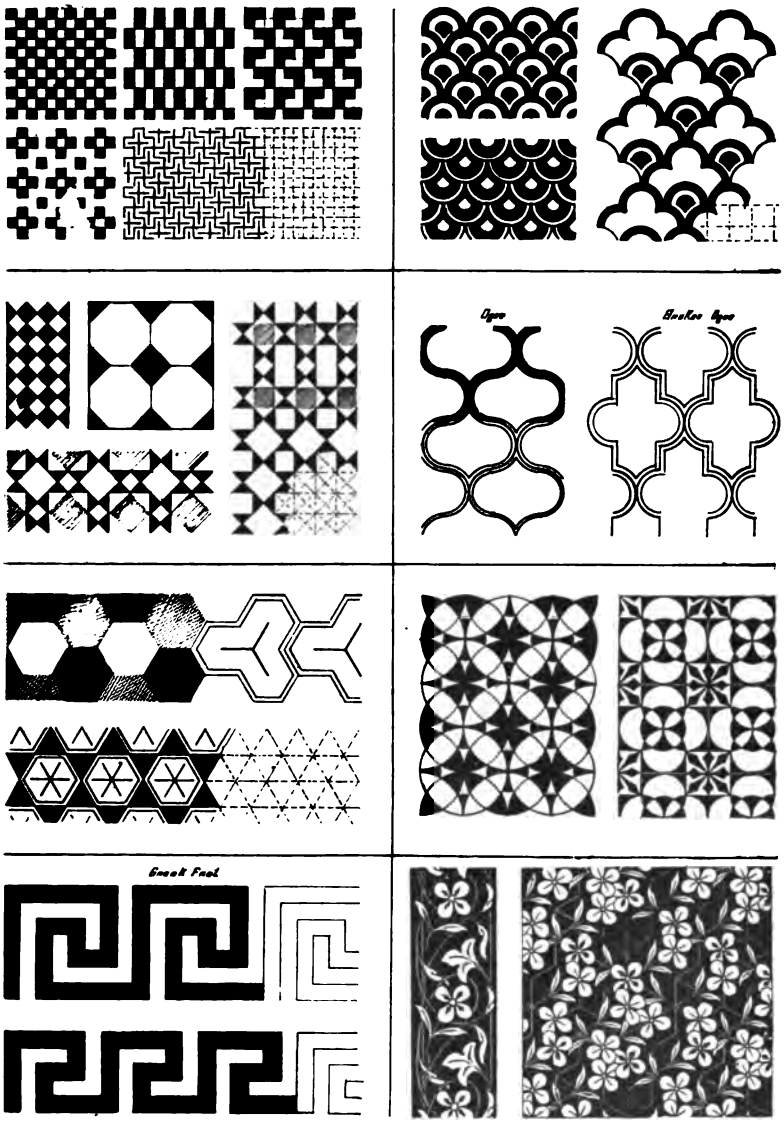
MOORISH BORDER MOTIVES.

order to get his ideas of what is decorative and festal, and especially he would work early in color, which, by the way, is persistently and consistently neglected in most schools of art till the last stages of the student's career, when, as I have tried to show, he has long passed the point where he is likely to be of any use as a designer. With this study of nature in her decorative aspects must be associated that conscious and deliberate adaptation of her forms to the purposes of practical design which is a fundamental in all practical work; intelligent conventionalization being the corner stone of all good work in applied design. This again is one of the things which the ordinary art student is very apt to neglect in just about the same degree as his powers as a technician become developed, and is therefore something which must not be left until his training is very far advanced, but must be taken hold of as one of the very fundamentals of his course.

Secondly, the practical design means an intelligent grasp of the limitations imposed by the processes of manufacture. Such character as industrial design ever assumes that entitles it to respect and consideration as bearing the impress of that indefinable quality which we call "style" is due to the frank recognition of these limitations, and to that wise adaptation of means to ends which such recognition, skilfully adapting itself to meet the conditions thus imposed, implies. It is through such practice as this that the student is prepared to take up the study of historic styles of ornament, because only in this way does he learn to understand style itself (a much more important matter, by the way, than familiarity with the style of any historic period). The historic work comes in due time, and the student becomes reasonably familiar with the ornament of historic periods whose influence have counted for most in shaping the decorative work of our own time. Grammar of ornament is almost as much a study of historic tradition as is the grammar of language, and this element of the problem can no more be neglected in the study of the one art than it can be in the other.

Of the all-important matter of color I have already spoken; it is systematically neglected in most schools at the only period of the pupil's development when it can be most profitably studied. Color furnishes the very first element of interest in textile decoration, and is the most elementary thing with which the decorator deals, so that its use should be one of the first things with which a textile designer becomes familiar. Its profitable employment, for that matter, may long precede any skill in drawing which is worth talking about. The beauty of textile fabrics depends on color, not only to a much greater extent than on the form of any decoration which is applied to it, but in numberless instances where no figure decoration is applied at all. Clearly then, a systematic study of color, without waiting for it to come at the end of the course in drawing, is one of the very first things to be considered in the education of the textile designer. Our particular aim in the Philadelphia Textile School is to set the student to work with color in such schemes as are represented by stripes and plaids, at the very outset of his career, and his mind is for some time occupied with the study of color problems as such. He is taught the fundamentals of color theory and the laws of harmony with reference to such elementary uses of color as these early forms of ornament represent, leaving all the more difficult work which requires skill in drawing to a later period.

With reference to the limitations imposed by materials and the processes of manufacture, the student of the textile school naturally approaches the subject of design from a somewhat different point of view from that which the art student occupies, and much less formal instruction on this point is necessary in his case. He learns to use his pattern as a woven pattern first, and the conventions which chiefly characterize the ornament come to him readily enough. That his experience furnishes the only true point of view from which to study the whole subject is so obvious a truth that I shall not insist upon it here. I only regret that so much valuable time has been wasted by instructors who know so little about the real nature of these



GEOMETRICAL BASES FURNISHING FOUNDATION FOR ORIGINAL DESIGN.

limitations, and therefore about the true character of all good textile decoration.

Conventions that are vital take care of themselves very readily when the subject is approached in this way. Those conventions which do not make their influence felt in this natural way may safely be left to take care of themselves.

At the Philadelphia Textile School, under the guidance of the School of Art with which we are associated, the pupil is exercised from the beginning of his career in decorative design, in the study of historic styles of ornament, and in the use of color, and high as is the value attached to the other branches of study, I have no hesitancy in saying that his future success depends more on the proficiency which he attains in this artistic work than on anything else that the school can give him. He comes to us very often handicapped by reason of inadequate preparation, for drawing is still the weak point in our public school system, and in preparatory schools everywhere, and the whole matter of art education is an untried experiment to many of our best boys when they come to us; but the association of our school with this, a great school of industrial art, enables him to make the utmost use of his time here, and no feature of our work has received more unqualified approval at the hands of experts who have studied it, than the branches to which I have referred. But the want of preparation in the first place is very apparent, and I regard it as one of my first duties on an occasion like this to make the most earnest plea I can for a fuller recognition on the part of those who have in their hands the shaping of our educational system, of the supreme importance of drawing in our elementary instruction. That a boy should pass through our public schools without attaining a reasonable degree of proficiency in free hand drawing, and even some skill in designing, is, I think, the most serious reflection which can be made on the system itself, and if my words today had no other effect than that of impressing upon my hearers the importance of this matter, and the sense of their duty as public spirited citizens regarding it, I should feel that my efforts had been well directed.

The PRESIDENT. Before we take an hour's recess to inspect the Philadelphia Textile School, I will call upon Prof. L. W. MILLER, the Principal, to give a few general directions upon the course which he desires you to follow.

Mr. L. W. MILLER. In welcoming you to the school, I ask that you will observe a little order and go with me taking a view of the rooms consecutively in an order that will create least confusion. You are a large body, and if we separate into different directions you will only impede each other and meet in the passages. Will you kindly proceed under my leadership turning to the left at the front door and taking a turn through our School of Art first, in order that you may get first a glimpse — because if you get into the cotton room you will not get out of it today — first get a glimpse of those things from which emanate most of those ideas in which as manufacturers we are interested.

[At the conclusion of Mr. MILLER'S remarks, a recess of one hour was taken, during which the members inspected the School of Industrial Art and Philadelphia Textile School, when the session was resumed.]

Mr. L. W. MILLER. The view we have just taken of it has by no means exhausted the facilities of the school; the passages are narrow and I was enabled to conduct so large a gathering without confusion only through a very small part of the school — one end of it. The further end of this wing has been almost entirely unvisited and this is the largest part of the school.

I wish the gentlemen and ladies to feel perfectly at home to visit the school any time today and tomorrow as freely as possible. You will find many things interesting in the unvisited section of the school. I also extend the courtesies of the Art Club (the management of the Manufacturers' Club, have, I believe, already extended you their courtesies and facilities), an

institution just above here, which — as we combine art and practical life — combines art and social features, and hospitality, and extends to you, through its unworthy secretary, all the privileges of membership during your stay in Philadelphia. I shall be very glad to see you there at any time during your stay in Philadelphia. You can obtain cards to the club from the registrar in the other room.

The PRESIDENT. We will listen to Mr. STEPHEN GREENE, of Boston, who will read his paper "Modifications in Mill Design Resulting from Changes in Motive Power."

MODIFICATIONS IN MILL DESIGN RESULTING FROM CHANGES IN MOTIVE POWER.

STEPHEN GREENE, Boston, Mass.

The critics of mill design have rarely charged inconsistency. They have frequently denounced the work as lacking in appreciation of the artistic, and in many cases the criticism was doubtless just. The limitations which generally exist compel the designer to adapt the building to the exact and specific requirements of the business. This may be true in a degree in general designing, but is more manifest in mill building.

The changes that tend to modify design are numerous. Among them may be mentioned:

(*a*) Increase in capacity of plant in a single building.

(*b*) Demand for better light and ventilation.

(*c*) Increasing demand for a better fire risk.

(*d*) Changes and improvements in machinery.

(*e*) Changes in motive power.

The aim of this paper is to deal very briefly with the subject of modification in mill design resulting from changes in motive power.

For the purposes of this paper the history of mill designing may be divided into three general periods. These divisions may not be so clearly marked as to stand out distinct from each other. On the contrary, from the nature of circumstances, they run into and lap over each other, but still the division may be made in a general way.

The first period may cover the time from the beginning of the factory system in this country up to the time of the general

introduction of the modern automatic cut-off steam engine, which date may be placed about 1860.

The second period may be taken as extending from the date just given to about 1893, when electric transmission began to be seriously considered in the driving of textile mills.

In the first period water power in its various stages of application was the ruling factor in motive power for textile mills. In the second period the steam engine disputed the sway of the water wheel and succeeded in taking the primary rank. We are just upon the threshold of the third period, and a large part of what may be said must be regarded in the light of prophecy and not history.

In the early days of the factory system the water power was in a large degree the controlling factor. The mill was located with reference to the water power, and the particular development of the power in hand controlled in a very large degree the design of the mill structure.

It has always been considered of prime importance in designing transmission of power, that the drive should be as direct and short as possible.

In the days of the water wheel when the breast and over-shot pattern of wooden wheels was in vogue, it seemed a necessity to so place the wheel with reference to the mill that short lines of shafting could be used.

It was therefore the common practice to place these large wooden wheels at the centre of the mill even though the building was a very small one, and then by vertical shaft and gear connections, and a little later by a belt connection, to transmit this power from the wheel located at the centre and in the lower part of the building, to the upper stories.

The topography of the site, together with the desire to secure economical power transmission from wheel shafts of low velocity, led the mill engineer to design buildings of considerable height and not covering a great deal of ground surface.

It is exceedingly rare to find a water power development where the fall is any considerable height, that affords a location

for a mill with a suitable and economical development of the power, that is so nearly level as to avoid one or more basements. It was frequently the case that two and even three full stories were built below the grade of the yard in the front of the mill, necessitating lighting this floor space from one side only.

The introduction of the modern turbine wheel, together with the demand for larger plants, marked a step in advance in mill design. It was found possible to place the wheels in such a position as would best suit the peculiar development of that power, and then to transmit the power through gears and shafting to some central point of distribution in the mill.

This gave an opportunity for a little freer development of mill design, in that more attention could be given to the exact requirements of the machinery and the organization of the mill, and less attention to the particular relation of the power plant to the machinery.

Quite a number of mills are now in existence, or were within a few years, where the change had been made from the old-fashioned breast wheel to the modern turbine wheel, but the design of the buildings gave clear evidence of the limitations that were imposed by the type of water wheel in use when the mill was actually constructed.

With the advent of the automatic cut-off steam engine, with which the name of Corliss is indissolubly connected, the field was opened for a still further modification of mill design.

It was no longer necessary to select a site by the river bank where the topography was more characteristic for its beauty than for its utility, but a spot could be chosen where a mill could be built much more economically, and where the requisites of light and ventilation could be met in a much more satisfactory manner.

The topography of the site selected, without regard to motive power, may determine in a large measure the design of the building, and inasmuch as the change from water power to steam power allowed a freedom of choice in the matter of site,

the simple change from water power to steam exerted a large influence in the modification of mill design.

In the early practice of transmission of power from steam engines, when slower speed of shafting was in practice, it was thought necessary to place the engine near the centre of the building so that the transmission of power might be attended with the least possible loss, but as higher speed of shafting became common, and more perfect construction in the bearings and couplings became possible, less objection was found to long lines of shafting, and in order to secure less interference with the machinery in the mill the practice finally prevailed of placing the engine near one end of the mill, and transmitting the power from the engine to the main shafts by belts or ropes located in a tower.

It may be stated at this point that the improvement in water wheels, and the adoption of horizontal wheels has rendered possible, in the case of water power mills, a proportion at least of that freedom in design which is more characteristic of the steam power mill.

The horizontal wheel with the draft tube, enables the mill engineer in many cases to place the wheels where the best results can be obtained and at the same time with slight loss in transmission of power place the building on a much more desirable site for the mill than was possible where the old type of wheels was used.

It is therefore evident that the first two periods referred to in this paper may not be distinguished absolutely as the water power period and the steam engine period, for the improvement in water wheel design has furnished opportunity for a greater freedom in mill designing, in some cases approaching that of a steam power mill.

It still remained true, however, in the second period, if the desire was to use water power, the mill must be located in the immediate vicinity of the water power development. If steam was to be the motive power, it was desirable to locate the mill

building at a point where the fuel could be delivered at an economical cost.

The introduction of the electric generator and motor, at first regarded as the toy of the theorist, and a little later as a luxury to be enjoyed by those who had money to throw away, was the sure prophecy of a complete revolution in the design of textile mills.

At last it seemed possible to select a site that should be most convenient for the essential requirements in manufacturing, viz., the securing of labor, raw material, and transportation of the finished product at a minimum of cost, and to erect a building that should be exactly adapted to contain the required machinery, arranged in the best possible manner to fulfil its functions.

The possibility was seen and recognized long before the actual realization was possible, for while it was theoretically possible to transform the mechanical energy of a water power or steam engine into electric power, and then conduct this power through copper wire to a motor located at the point of distribution of power, the cost of such apparatus, together with the large loss in transmission, was an effectual barrier to prevent its adoption in any large degree.

Fortunately, the study of electrical transmission and the perfection of the apparatus was entered upon and pursued with such perseverance and success, that we have already reached the point where it is not simply theoretically possible, but practically advantageous in many cases to locate the mill at the best possible point as concerns the design of the building and the organization of the machinery, and utilize the power at any considerable distance from the mill.

It would seem, therefore, that under certain conditions the mill designer may be free from the limitations of the location of motive power in the immediate study of the design of the building and location of machinery.

It has already been stated that in dealing with this third period we must necessarily treat, in a large measure, of possibilities and not of actual experience.

It is, perhaps, impossible for any one to prophesy the rate of development along the lines indicated. It can hardly be claimed with justice that at the present time the electric transmission of power has reached such a state of development that it is applicable in all cases. It is undoubtedly true today that if a site could be selected and the source of motive power, either the water wheel or the engine, so arranged that the power can be transmitted from the wheel shaft or the engine shaft, as the case may be, directly to the main shafts in the various departments of the mill, that no saving either in the first cost of installation or the economy in running would be experienced by substituting electrical transmission for mechanical transmission.

While this is true so far as a textile mill is concerned, where the load is practically constant throughout the sixty hours of the week, it would not hold in the case of manufacturing plants of other types where the load was not constant, and where different departments are likely to be run with varying loads and at different times. Under such conditions the time for the adoption of electrical transmission has already come.

There may also be cases where existing plants are so scattered, covering such an area, that no central power plant can furnish the power with mechanical transmission, with any good degree of economy, that electric transmission is practically applicable.

In view, however, of the remarkable advance that has been made in a very few years, it is not difficult to imagine that before many years have elapsed it will be perfectiy practicable and a positive advantage, even though the site may allow placing the motive power immediately within the building, to have the power transmitted to the various parts of the building by electric transmission, thereby modifying in a marked degree the design of the mill organization.

As an illustration of the possibilities in this line of development, reference may be made to the mill recently erected by the Pelzer Mfg. Co., Pelzer, S. C. The company had three mills containing in the aggregate 50,000 spindles, and grouped about the mill was the village with tenements, schools, churches, stores,

and other conveniences for the operatives. The company desired to extend their plant, and in anticipation of this had purchased a large tract of land with water power, some two miles and a half below the original mills.

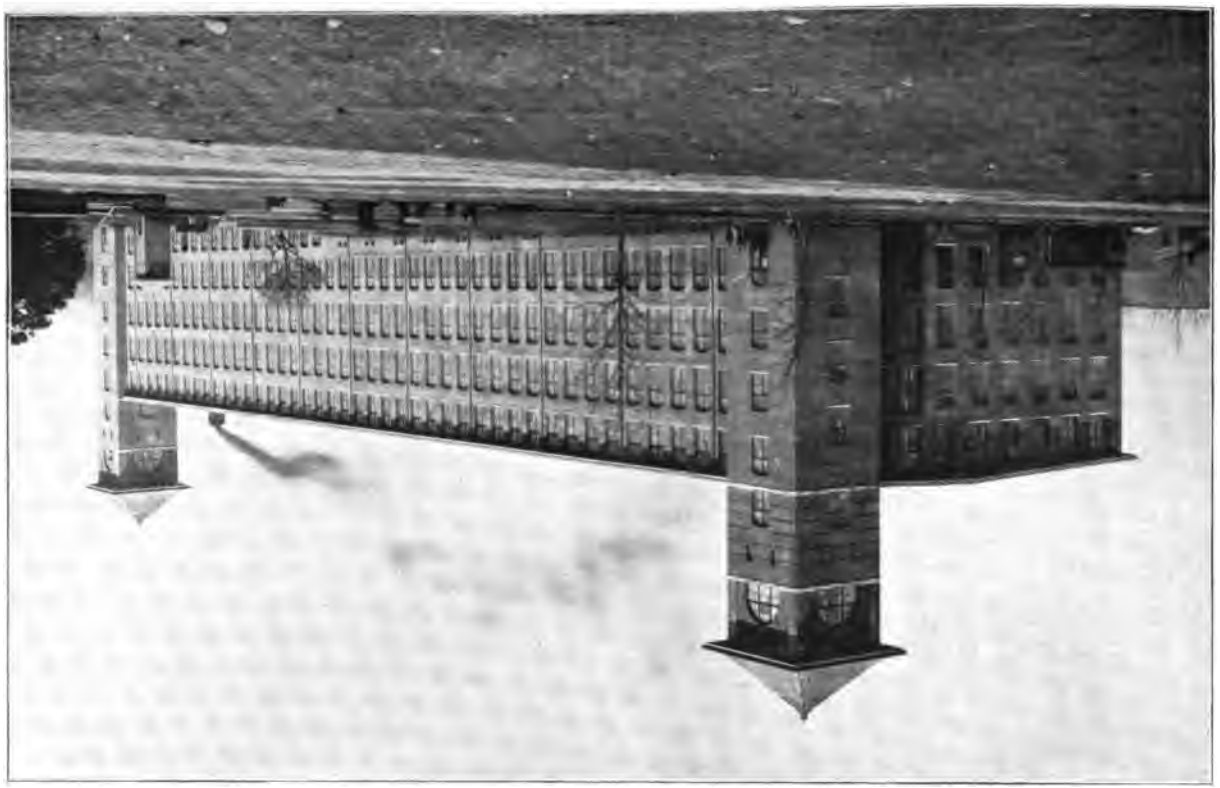
Their plan was to erect a mill at the site of the water power, but it was found that such a location would involve expensive foundations and a large outlay to render the site available for a large mill.

After a careful study of the question, it was decided to develop the water power at the most available point and erect the mill near the original mills on a site which was peculiarly advantageous, so far as construction was concerned, and transmit the power by electric transmission from the water power, two and one-half miles below, to the mill.

By doing this not only was the cost of constructing the mill building very much less, but many of the advantages of the town already in existence were available for the new mill, and the expense of a railroad to the lower site was avoided.

The mill has been erected and is in successful operation. The illustrations are given herewith of the power house where the power is generated, and the mill itself.

It is not claimed in this paper that at the present time electric transmission is universally applicable, but it may be claimed with propriety that under certain conditions the advance in the manner of transmitting power has made it possible to exercise much greater freedom in designing and organizing the modern cotton mill.



The PRESIDENT. We will now take up Topical Question No. 81: "In what particular is the mule as built today an improvement for spinning fine numbers over those of ten years ago?"

Mr. H. G. MCKERROW. The attention of manufacturers during the past ten years has been so insistently directed to improvements in ring spinning and the machinery pertaining thereto, that there are not a few, even of those who perseveringly endeavor to keep themselves well abreast of the times, who unconsciously assume that the cotton spinning mule has practically stood in its development during this decade.

This is not the case, and in Lancashire, where great advances have been made in the spinning of extremely fine yarns, the improvements in detail, in adjustments, and in time saving appliances, have been many. Not in the general principles, perhaps, have these improvements been manifest; the time seems to have gone by for sweeping revolutions in cotton manufacturing, or at all events in cotton spinning; but in details, in methods of driving, in the variation of the spindle speeds, new methods of double-decking, etc., the improvements have been many.

As the machine men are expected to take part in the discussion of this question, and as each one can only regard it from the point of view of the machine in which he is particularly interested, I venture to describe briefly a few of the points adopted on the Threlfall mule to make it more applicable to fine spinning.

In the Threlfall special mule, adapted for spinning counts up to 350s, a variety of new motions are employed, notably among others an improved method of giving a second speed to the spindle whilst twisting at the head. This is arranged in such a way that when the single or spinning speed is altered, when changing counts or qualities, the double speed is not affected, and the shortest possible time for putting in the required twist is thus consumed. In the twisting of yarns of the finer counts on self-acting mules, it is customary to give only a portion of

the twist when the carriage is running out, and to put the rest in when it has arrived at its outermost position.

Many devices have been adopted for this purpose, and the problem is one requiring delicacy and exactitude. It is complicated, also, by the necessity which exists for the absolute arrest of the motion of the spindles, prior to backing off, an object by no means easy to effect. The momentum of the parts has to be overcome, and this has always constituted one of the chief difficulties.

The rim shaft is made in two parts, on each of which a fast pulley is fixed. If desired, however, there may be a continuous shaft surrounded by tubular shells, which terminate with the bosses of the fast pulleys. If the divided rim is used, the ends of the two parts adjoin each other, and the loose pulley runs on the shaft or tube between the fast pulleys. On the end of one portion of the rim shaft a rim pulley is fixed, while a second rim is fastened on the end of the second portion, which is extended towards the front of the mule for the purpose. It must be noticed that the pulleys are of different diameters, so that if it be assumed that the rim shaft runs at a uniform velocity (which it does), the velocity given to the band will depend upon which of the pulleys is being driven. The band is an endless one, passing over each of the pulleys and the tin roller pulley in the carriage square.

The strap guide is controlled by means of a cam and its attached gearing, which does not greatly differ from the mechanism ordinarily employed. The backing-off cone and wheel are fastened to the rim shaft, and are operated by levers. The boss of one fast pulley is conically bored, and a brake wheel is placed so as to run loosely on a bush; this wheel carries a brake surface, which slides on it, and is formed with a ratchet surface, with which pawls engage, these pawls permitting of its free rotation in one direction, but arresting its motion in the other, and being sufficiently broad to permit the surface to slide longitudinally. A connection is established between the backing-off

friction and the brake surface, so that the application of the former is followed by a similar connection of the latter.

It follows, therefore, that when the carriage arrives at the head, the belt is traversed from one fast pulley to the other, thus giving the quicker speed to the rim pulley. When the twist is completed, the belt moves on to the loose pulley, and at the same time the backing-off friction and the second brake shoe are simultaneously applied, thus bringing the rim shaft and spindles rapidly to rest and reversing their motion. It will be seen that by this device there is an increase of brake power, which, in these days of long mules and high speed, is of immense importance. Similarly, the release of the backing-off friction is followed by the release of the brake shoe. It is evident that this arrangement possesses many advantages, being compact and comparatively simple. The excessive friction caused by throwing the whole of the work on to one cone is obviated, while all the advantages of a simultaneous motion are retained.

When two rims are used there is a friction on each shaft for stopping the spindles preparatory to backing off, saving considerable time in bringing the spindles to a stand. In some cases, even when spinning 120s yarn, the speed is increased to 11,500 revolutions per minute when twisting. This motion is an improvement (apart from the fact that the single speed is changed without affecting the double speed), in that it is entirely contained in the headstocks, and is not at the top of the room, as commonly employed.

In the event of the yarn getting hard with twisting at the head, a motion is employed for turning the rollers slightly, thus obviating the twisting down of the yarn at the nip, and saving piecing and waste. Any amount of yarn, from $\frac{1}{16}$ of an inch to $\frac{1}{2}$ of an inch, can thus be turned through the rollers, and the speed of the rollers may also be varied to suit different qualities and counts.

Another improvement is a novel jacking or ratching motion for driving the carriage after the rollers stop, at a slow speed,

a distance varying from ½ of an inch to 7 inches, according to requirements, and to suit different cottons. This motion may also be varied in speed without altering the speed of drawing out, as there is a separate change wheel for this purpose, and the drawing out is accomplished by a catch box instead of lifting wheels.

It will not be necessary to enter into technical descriptions of the copping motion, by means of which the cop can be varied in thickness, and the cop bottoms and chase varied quickly and easily; or the Threlfall patent scroll band; or the improved quadrant, and assistant winding motion. The latter is, however, ingenious enough to warrant a few words.

The quadrant is supplied with a nose peg which can be adjusted with the utmost nicety. A narrow pulley is fastened to the rim shaft, besides the loose pulley which gives motion to the backing-off, and by a simple contrivance the backing-off belt may be moved from the loose backing-off pulley on to the pulley which is fastened to the rim shaft, just a few inches before the carriage completes its inward run, thus giving an extra impetus to the spindles, and causing the yarn to be wound tighter on the nose of the cop.

Still another improvement is the patent roving conductor, which allows the use of very soft rovings with but a little twist.

I have but briefly alluded to the points towards which, as the demand for adjustments more and more delicate and exact for fine spinning arose, mechanical attention has been directed and it may be thought even from this that the mule has become too complicated a piece of mechanism for any ordinary purpose.

When it is borne in mind, however, that when the spinning of yarn above 100s is considered, it is quality and not quantity which must receive the first, the last, and all the attention; when it is remembered that the great irresponsible, nerveless mass of iron and steel is required at a given moment to spin out of its intestines hundreds of fragile, delicate filaments, not one of which would, of its own strength, bear the weight of the spindle on which it is spun, it will not be felt that the machine

has been supplied with nerves, with instinct, to too great an extent.

I have here a few cops (all more or less injured by handling) which gentlemen may be interested in examining, and which were spun on the Threlfall mule. They run from 110s to 320s, and illustrate the best work in Lancashire today. They are made from Sea Island cotton chiefly, although some of the lower counts are made from Sea Island and Egyptian mixed.

Mr. WILLIAM WHITTAM, JR. In contributing to the discussion of this question, I will, with your permission, digress somewhat from the exact question as stated, and direct your attention to such details of construction in mules for spinning fine numbers — some of these details being essential and others desirable — in which they differ from those intended for the production of yarns ordinarily designed "coarse," as well as to deal with the direct question by referring to such recent improvements in construction, as are particularly designed to facilitate the production of either a better quality or larger quantity, or both, of the higher numbers of yarns.

The production of the finest yarns, such as are used in the spool cotton industry and for other purposes, demands a close attention to mechanical detail, and the nicer points of the manipulation of the threads, individually and collectively, during the spinning process, since strains such as are attributable to the general construction of a machine built for heavier yarns and to which those in the ordinary range are necessarily subjected, would be disastrous to those of very fine counts.

That this is so can probably be more readily appreciated by those whose experience has been altogether in the manufacture of lower numbers, when it is stated that I have frequently had to spin No. 120s for a special purpose with only 23½ turns per inch of twist.

A detailed description of the mechanical means employed to attain the more perfect control essential in the machine under

consideration would be tedious to you and probably not so interesting as a brief general review of the subject.

In most types of mules for yarns within the ordinary range of counts, the principal "changes" are controlled and operated by a combination of "clutch box" and cams; while in at least the two styles of machine which are possibly most extensively used in the "fine trade", an arrangement generally known as "the long lever" is substituted to operate the three principal changes and their adjuncts. That this arrangement is better adapted to the purpose, owing to its more perfect application and adjustment, is to a considerable extent admitted, and its advantages would seem to be demonstrated by its very general use, for whenever a piece of mechanism is found to be particularly suited to any special purpose, its application becomes, as in this instance, almost universal. Two of the most evident points of superiority of this appliance are:

First. The easy manner of bringing into action the "backing-off friction", thus locking the fallers more gently so as to minimize the strain on the yarn at this point.

Second. The possibility of the winding faller descending below the position required is almost entirely obviated. This in fine spinning is very desirable.

The inventive skill of both spinners and machine builders in perfecting the self-acting mule, to render possible the production by it of very fine counts, was most heavily taxed in overcoming the difficulties incidental to making the necessary changes, and perhaps the proper control of the fallers at each period of their operation presented problems as difficult of solution as any. To equal, not to say excel, by automatic mechanical contrivances the hand of a highly trained spinner, developed to such a high degree as was common amongst the "old school" of hand mule spinners, was on its face no inconsiderable undertaking, and one which may be said to be not yet fully accomplished. And it may be, as has been asserted, that since any mechanical arrangement, no matter how near per-

fection it may be brought, cannot be endowed with human intelligence, this desideratum will never be fully attained.

Within the past ten years the advance made in having the unlocking of the fallers, when the carriage arrives at the end of its inward traverse, under more perfect control has been improved materially.

If the time of unlocking should be premature, "snarls" are put into the yarn; or if unlocking occur too late, cut and broken ends are the result. Arrangements are now applied which enable this motion to be perfectly adjusted, and which are also so constructed as to automatically vary the time of its operation, earlier or later, as may become necessary by the irregular speed of the carriage, such irregularities as is well known are often attributable to causes foreign to the machine.

An improved and satisfactory motion for allowing the faller to rise at a variable speed after unlocking has been introduced within the past few years. This so graduates the speed of the upward movement of the wire as to coil the threads uniformally upon the spindle blade, and is necessary in fine spinning, owing to the tapered form of the spindle. With the application of this device, it is essential that some means be provided for its being brought into operation in such a way as to absolutely preclude its acting during the time the faller unlocking arrangement is operating, obviously a necessary precaution. It is therefore arranged so that the former motion is controlled by the latter.

An appliance for giving a slower initial speed to the spindles, during the period of action of the "raising motion" just mentioned, is also attached and works in conjunction with it.

"Anti-Snarling" motions of considerable merit are now used more frequently than heretofore, and motions of improved designs for depressing the winding faller and elevating the counter wire have reduced the liability to injure the yarns during "backing-off".

It is essential that the faller wires should be brought in contact with the threads as soon as possible after the spindles

begin their reverse motion, and the distance through which the fallers must pass before they overtake the uncoiled yarn, is by this attachment much reduced.

It is quite possible to so regulate their motion that at the moment they impinge upon the threads, they shall be controlled so perfectly as to entirely eliminate any injury to the yarn, which might be otherwise caused by the speed of the wires being too great at the time contact with the yarn takes place.

It must be remembered, however, that the beneficial results sought to be attained by these means would be lost, if some suitable arrangement was not applied to take up the slack in the "backing-off chain" caused by this anticipated faller movement, and for this reason some modification of the ordinary "backing-off chain tightening motion" is usually applied.

That the facilities for changing "counts" and "turns per inch" by small margins have been much improved during the period referred to in the question, is doubtless known to you all.

The time is not long past when the conveniences in this direction were meagre in the extreme. This has been brought about by enlarging the diameter and reducing somewhat the "pitch" of change gears. A moment's consideration is enough to prove the comparative accuracy with which any requisite change in the "twist" or "draft" of the same counts can be made with a gear having 60 teeth, as compared with one having only 36 teeth, and this is about the ratio in "size" of gears as between present practice, and that obtaining some ten years ago.

Many parts with functions of vital importance which were formerly produced more or less by "rule of thumb" are now carefully made to template; this is especially so in the case of copping rails and plates, the latter being now applied in duplicate.

The relative merits of long and short "copping rails" have been much discussed by practical men engaged in fine spinning, and need not be touched upon at this time, beyond asserting

that for mules which are to be erected in old buildings whose stabilily is imperfect, "short rails" are most suitable.

Faller shafts are now arranged to work on "anti-friction" bowls, thus giving a more perfectly uniform action, responding to any irregularities in tension instantly; and by their adoption the yarn is treated in a way to tend towards a better quality of product. On the nicety of the balance of these parts, much depends; any unintentional or abnormal strain during winding must be controlled quickly and with precision. Whenever tension is too strong ends are broken, while slack threads are responsible for soft, badly formed cops, producing waste in abnormal quantities in subsequent processes; costly in coarse work, but immeasurably more so in fine counts.

The passing of the old "nose peg" and the substitution therefor of a comparatively perfect and approximately automatic, apparatus, for regulating, or rather increasing the spindle speed during the winding operation, just so much as to compensate for the tapered form of spindle, is worthy of notice, its beneficial effect in the direction of improved spinning being apparent. The old "peg" arrangement, being altogether dependent for its successful manipulation upon the attention and skill of the operative, was far from satisfactory; some of the later "automatic nosing motions", so called, being little better; variations in winding, and also in the general qualities of yarns are inherent, and for these reasons an absolutely automatic motion that will give just the requisite compensation under the multitudinous variations that arise in every day working, is yet to be devised; and although badly formed "cop noses", brought about by imperfections in this motion, are not found so commonly as they were ten years ago, they are not by any means rare today.

Carriages are now made both stronger and lighter than formerly, and the general introduction of "diagonal rods" and their subsequent modification so as to give greater rigidity to the carriage are improvements in detail which have reduced the tendency to cut and snarl the yarn.

The increase in the number of bands to control and steady the movement, and maintain the parallelism of the carriage and roller-beam, throughout the outward and inward traverse of the former, combined with their modified attachment and perfected adjustability have also contributed much in the same direction.

The "roller delivery motion" for delivering a few inches of yarn during the winding operation, whilst not of recent introduction, has a tendency to relieve the tension of the threads during winding-on; and although its use is condemned by some, on mules for coarse and medium counts, its advantages are very generally admitted for the finer numbers.

The simplicity, positive operation, and ease of adjustment of the different mechanisms for producing "gain", "second stretch", and for "twisting at the head", and also for causing the front rollers to deliver sufficient yarn during the time this "head twist" is being put in, have been extensively improved, and although the two former motions are not of recent introduction, their construction has been in some cases so modified of late, as to constitute a distinct improvement. This latter arrangement is superior in every way to its predecessor the "receding motion", which was unmechanical, and also unwieldy to a degree. The production is also slightly increased by the more recent attachment.

The extension of the "block system" is responsible for a reduction of the serious losses in production, caused by breakage of parts, brought about by opposing motions being accidentally put into operation at the same time; this evil is now practically eliminated in the modern mule.

A most important factor in the production of extra fine counts is that known as "single and double speed". With the introduction of this device, the possibilities of the machine were enlarged. The arrangement consists, primarily, of two pairs of tight and loose pulleys, whose arrangement is such that one pair will act during the outward traverse, the second operating the spindles during twisting at "the head", with a suitable

arrangement for bringing each pulley into operation at the proper time.

The full benefits of "gain" and "second stretch" in fine, hard twisted yarns, can only be obtained with the aid of this attachment; without it, full scope cannot be given to the two former motions. If the spindle velocity during the operation of the single speed is taken at 5,500 revolutions per minute, their revolutions while controlled by the double speed would approximate 7,900 per minute; the production is thus considerably augumented without detriment to the yarn.

In conclusion, it may be said that during the period under consideration the numerous improved modifications of the appliances for starting and stopping, at the commencement and termination of each operation, have been such that an increase has been made in the number of necessary individual motions; yet, the changes of these are now made more smoothly than previously, and with greater precision, so much so that strains on the yarn which ten years ago would have been considered quite normal, are in recent machines so diminished, that there is quite a noticeable improvement in the quality of the threads produced, and the possible output per spindle is also much increased.

These facts considered with the enlarged facilities for the more perfect adjustment of motions in every direction, by which it becomes easy to set the numerous parts to work in practically perfect harmony, makes the modern mule for fine spinning capable of producing yarns of finer quality, and altogether more perfect in general characteristics than was possible some years ago.

With intelligent supervision and a thorough appreciation of all the conditions necessary to produce satisfactorily the highest numbers, much can be done. I have seen 300s spun on self-acting mules in Lancashire, and have produced in this country 200s in quantity, and occasionally 250s of such quality, as to compare favorably with the best foreign spinnings.

Mr. JOHN T. MEATS. In the paper contributed on this subject at the spring meeting, it was stated that, with good preparation, 30 hanks per spindle of 80s yarn was being produced per week of 58 hours; and as that statement seems to have interested some of the members, it may also be of interest to add that it was done on the latest improved American mule, without special effort; and that the yarn was carefully weighed, beginning with bare spindles on Monday morning and ending with bare spindles on Saturday forenoon. The stock was Egyptian; and it goes without saying that with Sea Island it could have been done with even greater ease. The mules were 1¼-inch gauge, 1,600 spindles to the pair, each pair being operated by one spinner without the assistance of a "piecer".

Mr. E. A. LEIGH. In self-acting mules very important improvements have been made in the last ten years, chiefly in the direction of strengthening the parts, using larger diameters for the backing-off and drawing-in frictions, introducing duplex driving, and a general reconstruction of the headstock for giving greater strength, so that long mules can be worked continuously without any breakdown.

All the motions which go to make accurate backing-off, winding and nosing are in principle perhaps very much the same as they were twenty years ago, but there has been a refinement and accuracy in the details of construction, which makes all these motions much more reliable, and requiring less attention from the minders than formerly.

All these improvements have been equally applied to mules for spinning fine numbers, because the tendency during the last ten years has been to make mules longer than formerly. A mule of 600 spindles on fine counts might formerly have taken 4 horsepower to drive it, while a mule of 1,300 spindles would have taken 8.66 horsepower, running at the same speed, but with the great improvement which has been made in the manufacture of steel spindles, hardened and tempered, and their in-

troduction on fine mules as well as mules spinning coarser numbers, these spindles can now be run from 10,000 to over 12,000 revolutions, and instead of requiring only 8.66 horsepower at the old modern speed of 7,000 revolutions, they will now take about 12 horsepower, so it will be seen that the headstock of ten years ago, which was suitable for 7,000 revolutions, would be entirely unsuitable for mules of the present long construction and fast speeds.

That these new mules are well adapted for spinning fine counts is apparent from the very large increase made in the United States during the last ten years of mules for spinning fine counts and the results obtained. It will be generally admitted by all manufacturers that with the enormous increase in the manufacture of coarser counts in the South, the present trend of extensions in New England will largely be on finer counts than formerly. It will also be admitted by practical spinners that when numbers above 60s of good quality are wanted, the mule is the machine best adapted for producing that quality. When it comes to numbers 60 and above, the primary point to be attained is quality, the quantity being of secondary importance, but with the energy with which manufacturing is taken up in the United States, the secondary point is certainly not neglected. When visitors can go into some of the best mills here and see 90s of good quality spun at a speed of about four stretches per minute, as well as the finer numbers up to 180s where the speed is correspondingly high, nearly 2½ stretches a minute, and compare these results with what was obtained not many years ago, it will readily be seen that the question is a very important one to the advanced cotton spinner.

SECOND SESSION.

Afternoon session, Wednesday, October 27, 1897, devoted to an excursion on the Delaware River and visit to Cramp's shipyard and the Baldwin Locomotive Works.

THIRD SESSION.

WEDNESDAY, OCTOBER 27, 1897, AT 8.30 P. M.,
MANUFACTURERS' CLUB, PHILADELPHIA.

President RUSSELL W. EATON in the chair.

Paper on "Picking and Carding", read at the last meeting, by Mr. MARCELLUS GOULD of Norwich, Connecticut, was taken up for discussion.

Mr. THEOPHILUS W. WILMARTH. We are requested to discuss the able paper of Mr. MARCELLUS GOULD on carding. Though not pertinent to the subject, we consider the opportunity of reading before, and discussing at the meetings, the topical questions, a great improvement. Cotton, the beginning and end of all our troubles, is rarely selected by the men who manufacture it into cloth; there is one important factor left them,

however. They can, from the stock on hand, select a proportionate number of bales from each lot, making a mixture that will secure a grade nearly uniform in character, that will produce even work. Compressed cotton, opened and allowed to remain in a bin a few days, will give better results than that used immediately, but four years' experience in the South taught us that cotton brought directly from field to mills worked less satisfactorily than the same cotton after compressing. We have seen a fine spray of water throwing a fog into the cotton in the process of compressing, and afterwards using the cotton, finding it uninjured and making very strong yarn.

We prefer classed and graded cotton to the "hit or miss" stock that many mills in the South are using, and do not believe the advantage is as great as sometimes depicted. The atmospheric influence that has such remarkable effects in carding, is not always to be controlled in ordinary rooms by ordinary carders. The exact amount of humidity and the best manner of obtaining it is still a problem not entirely solved. In many of the old and some of the new, a carder knows better ways than those he is managing, but circumstances and the poor arrangement and construction of the plant prevent his obtaining the best results.

A first-class plant with every machine the best of its kind, each preceding set of machinery adjusted to produce the proper amount and good quality for that which is to follow, and a man of ordinary ability, can make a success. With most mills this is not the case, and a man with experience, a level head with more than an ordinary amount of brains, is a necessity.

The English and American systems of carding have able men to support them. We believe a revolving flat card, working a proper amount of cotton, can be made to do the work of any double carding relative to quality. We know of revolving flat cards producing 1,080 pounds in 58 hours "good enough for prints". These same cards run on the same basis for amount of work accomplished, as double system, would give equally as good results. We tried revolving flat carding with two systems

of drawing, and we were better pleased when we adopted railway heads and one system of drawing.

Card clothing is usually bought by someone who may or may not see the results of the purchase, and the carder must do the best he can with what he has, but good judgment in drawing it on must be exercised. We prefer "spaced filleting" to the ordinary kind, believing there is less tendency to roll the fibre. We prefer in stripping our cards to make a business of a section, then starting the whole, returning to the picking department the first half can of production, from railway or card head, thus avoiding light strands.

Twist is a subject that individual circumstances must control. We have found uneven stock to give stronger yarn and to spin better when more than standard twist was in the roving. On the other hand, even and clear stock with less than standard twist in the roving, gave the better results.

When all is said and a summary taken, there has been no "cure all" invented for a carding room. The nearest approach to it is a careful, experienced carder, whose watch word is "eternal vigilance". These do not always produce perfection, but it is worthy of any carder's ambition to reach this mark.

Mr. EBEN C. WILLEY. The subject of picking and carding was handled in a very able manner at the last meeting of this Association, and while all present may have their ideas regarding the matter, I will present some of my own.

You all realize the value of mixing cotton thoroughly, and the ideas advanced in previous article cannot well be improved upon. And while we would like to make an ideal mixing of cotton, we do not all have the room to do so, therefore are obliged to govern ourselves by the conditions under which we are placed.

The automatic feeder is a necessary attachment to an opener or breaker lapper, and while it feeds evenly if hopper is kept properly filled, it is also a good mixer, for the reason that the

stock is being constantly turned over, thereby mixing it thoroughly.

There are many ideas regarding openers, and from my own observation and experience, I believe the large, rigid beater (knife blade) will do the best work as regards cleaning and opening of stock, as there is less tendency to ball or roll the same, which makes it harder for the succeeding beater to clean properly.

A cleaning trunk placed between open and breaker lapper where convenient, is of great advantage, and takes the place of one beater as a cleaner. The breaker lapper is a cleaner and forms cotton into first lap, and may be one or two sections.

A modern picking plant should consist of single section intermediate and finisher lappers for several reasons. First, for the doubling. Possibly some of you may say that doublings on a lapper don't amount to anything, but if you will watch the laps on aprons of intermediate or finisher lappers as they are being fed into machine, you will notice that the appearance of the laps changes in every set, even in the best regulated picker rooms, and here the doublings help to make the appearance of finished laps for cards more uniform in thickness, cleaner, smoother, and evener in weight, which is very perceptible on cards, both in sliver and card strippings.

Second, the intermediate process will give you more even laps for the finisher lapper, with the result that the laps from finisher vary but little in weight, which is very essential on the English carding system, if railway heads are not used.

Third, why do we get cleaner picker from the intermediate process, even though we use the same grade of stock with same number of beaters (generally less)? If those of you who have the old style two-section finisher lappers, will please note the difference in picker waste under first and second beater, you will be surprised at the greater amount taken out by beater next to evener, on account of cotton being fed to beater in a thicker and more compressed state. The heavier the feed, the cleaner, whiter and evener the cotton will be spread on dust cages.

If laps from finisher lapper weigh twelve ounces per yard from intermediate, best results would be obtained by making sixteen ounces, and from breaker lap twenty ounces. No rule can be adopted for regulating the draft of picking machinery, as conditions vary in different mills. The quality of picking depends on drafts, setting of beater to feed rolls, and amount of cotton fed to beater, which also regulates the setting. The lighter the feed, the closer the beater can be set. The opener beater should be set one-fourth (¼) inch from feed rolls; if feeding very heavy, five-sixteenths ($\frac{5}{16}$) inch. Breaker lappers, three-sixteenths ($\frac{3}{16}$) inch to one-fourth (¼) inch; intermediate lappers one-fourth (¼); finisher lappers, three-sixteenths ($\frac{3}{16}$). In regard to the speed of beaters under ordinary conditions, 1,200 to 1,300 for an opener, and 1,500 for breaker intermediate and finisher lappers.

I would also add that I believe in the near future our lappers will be improved by beater and grid arrangement, so that we shall have a lap almost entirely free from leaf. In fact, I expect to see beater and grids set with same nicety that we now set licker-in on a card.

Carding is a part of the manufacture of cotton goods that we look to for the success of our mills, and broadly speaking, covers the most important branch of the industry. To get good carding is the aim of every manufacturer. You are well aware that no two carding departments are arranged the same. Or, in other words, conditions vary, and while some of us have an abundance of carding, others do not, and are obliged to push their carding in order to keep up with the spinning department. The methods vary in different mills, and which is the best no two men will agree upon, and men working entirely contrary seem at times to be getting equally good results.

I will speak more particularly of the common top flat card, although the principle in some particulars may apply to the revolving flat card. Since the introduction of hardened and tempered steel wire, it has been possible to make clothing with finer wire, and while some years ago No. 32 and 33 wire was

used, we have now adopted from No. 34 to 36 and finer with better results, even with an increased production.

On common top flat cards, I believe the best results can be obtained by using No. 34 wire on cylinder, 34 on top flats and 36 on doffer, the wire on doffer to be set about 76,000 points per square foot. More points make doffer too near a solid surface, which is not desirable, and I may add that I have seen very poor carding from above cause.

The foundation for the wire ought to be either double cover cloth or flexifort. I have always obtained the best results using 1⅛-inch wire, which makes length from crown to point ½ inch, regular length $\frac{7}{16}$ inch. It is more flexible, less liable to injure the fibre, and the tops particularly will take out more foreign matter.

Which is the best clothing for cylinder, sheet or fillet? From my own experience I have demonstrated that fillet is the best if you have licker-ins attached to cards, and sheet clothing if cylinder takes cotton direct from feed rolls.

Put clothing on tight as possible so that it will not need drawing over, as a good cloth foundation does not stretch like leather.

I know of no rule to be adopted as regards the grinding of cards. Judgment should be used in the matter, for, if using fine emery, it will take less time than with coarse, and there is no doubt that more injury is done to our card clothing by over-grinding, than in the work performed in carding cotton.

The setting of a card is an important matter and requires skill and judgment, for a card must be set well in order to get good carding. The more heavy the carding, the more careful the setting, and let me say right here, that the doffer and feed rolls on a common top flat card can be set as close to cylinder as on a revolving flat card. Tops can be set very close, even if made of wood, and should be set so that a slight pressure on them while cylinder is running, will cause tops to touch same, and the back tops on a card in order to get the best work should be set as close as those at front, and if all tops are pitched alike, those at the back or next to feed rolls will do their proportionate

part of the work. If carding heavy, it would be impossible to do otherwise and get good work, for top flats play an important part as regards clean work.

Tops should be ground heavier than either doffer or cylinder, as the rougher the point the more leaf, nits and short stock will be taken out.

Which is the best draft for a card under ordinary conditions? For single carding I would recommend from 100 to 125. Longer would do no harm, for the heavier the sheet of cotton delivered to cylinder, the more even and uniform the carding will be if lap is properly held by feed rolls, for as the feed is slower, it gives the cylinder or licker-in more time to teazle the fibres of cotton, separating the leaf from same, making the cotton delivered from card whiter and clearer. The card strippings from cards having a long draft and heavy feed, you will find contain more leaf, short stock and dust, although per cent. of waste will remain the same if feed rolls are properly weighted.

I would recommend a lap 12 to 14 ounces per yard for cards, although I have seen 16 ounces used with excellent results on double carding system. The best results can be obtained with quick-running doffer and light sliver, for the lighter the sliver delivered from doffer the less cotton on cylinder, consequently the tops have a better chance to catch and hold that part of the cotton we most desire to remove. There is also less liability of the cylinder becoming filled up and making nitty work, which you are well aware we are obliged to guard against all the time.

Mr. ARTHUR H. GULLIVER. The able article on picking and carding that was read at the April meeting covers the subject so thoroughly, that I shall call attention to only a few of the points mentioned.

The success of our carding and the quality of the yarn depends upon a thorough mixing of the cotton, so that the blending of staples shall be as nearly uniform as possible, every week of the year. The breaking of each compressed bale into small pieces, scattering it over the bin and using the stock thus

spread from top to bottom of the pile, insures an even distribution in the hopper of the self-feeder. The cotton should be mixed not oftener than once a week, if it is possible to do it. But we are frequently compelled to use one or more invoices that are very much inferior to the average staple; these should be so mixed that this inferior stock will form as small a part as possible of the weekly mixing, and no change made until it is all used up. Would say further that if we have any very sandy, leafy cotton that contains a large amount of heavy dirt, much worse than the bulk of the stock, it would be a matter of economy to run this through a single beater opener before mixing with the other stock. This would give a more even mixing, as it would be partly cleaned, and more like the average of the stock in the bins.

The eveners on the intermediate and finisher pickers require most careful attention with the general use of the revolving flat card. The great improvement in these during the last few years has given more accurate adjustment and easy regulation. The slower speeds of the various parts and smaller amount of breakages without loss of efficiency, is what should be demanded of the machine builders. They should correct quickly any irregularity of the laps, although they are hardly to be depended upon to deliver the first lap after one of the four on the apron runs out at the exact weight, but the next certainly should be all right to put on the card. Every lap should be weighed before they are sent to the cards, and on medium numbers of yarn only eight ounces of variation either way from standard weight should be allowed; all other laps should be rejected and run over again. As most of this weighing is done by one of the hands in the picker-room, it is an excellent practice to have the laps re-weighed at irregular intervals by the second-hand or overseer; in this way there is much less chance of running any laps in the cards that are too heavy or too light.

In putting the clothing on a revolving flat card it is absolutely necessary to use a card mounting machine that indicates accurately the pressure being put upon the fillet as it is drawn on.

If the clothing thus handled is not subjected to an irregular strain, but brought gradually up to the required amount, and kept steadily at this point, should not hesitate to put on a two-inch fillet with 300 to 325 pounds, and an inch and a half with 200 to 225 pounds. A great deal of clothing has been spoiled by careless handling and condemned, although the fault has not been in the clothing itself. Right here comes in the point of the best foundation in which to set the wire. The conditions of climate under which the clothing is to be used should determine its construction, and it should be so built up that it will retain its pliability under the conditions to which it is to be subjected. There is no difficulty in setting the top flats, as well as the doffer, as close as they will run, and make the best carding. They should be kept in first-class condition, and will give better results by not using the burnishing roll unless absolutely necessary. The tops should be ground from the working surface, provided that this holds the flat in the exact position in which it rests while doing its work on the card.

Good work in every process of the carding is the only sure safeguard for securing the best results in the spinning and weaving, and the only way it can be obtained is by keeping up a personal pride among the hands employed, in the order, neatness and general condition of the room. Do not we too often think that any kind of a hand will do for a card stripper or a drawing tender, provided the required number of pounds are put through a machine? We ought rather to make well paid work go with low cost by the most careful attention to the arrangement of the hands in this department.

The requirements of drafts on drawing frames and speeders are so different in different mills, that it is hard to lay down even an approximate rule. A gradual increase in each process from 4.20 to 5.00 on first drawing, to 6.00 to 7.00 on fine speeders, will give the best results. Should not consider it a mistake to use less than three processes of drawing, but do not find any trouble in using the three and getting good results from it. In deciding what size of bobbin to use in each process, use as large

as possible for the hank required. This would apply also to the number of spindles on each machine; put as many in each frame as can be run satisfactorily with the least labor, each tender to run a pair if possible. The longer traverse with no increase in space will give fewer piecings and make it possible to run finer roving without any injury to the stock. In conclusion would call particular attention to the three points most essential for good carding: careful mixing of the staple, accurate work in each process, and constant care to maintain thorough order in every detail of the room.

The paper on "Weaving as a Fine Art," read at the Boston meeting by Mr. ALFRED HAWKESWORTH, Montreal, Canada, was taken up for discussion.

Mr. JOHN ECCLES. Mr. HAWKESWORTH'S paper was a carefully prepared one and gave formulas for eighty-three various kinds of fabrics, as well as the different qualities of cotton to be used and the special twists to bring out the best results and meet the keen competition existing at the present time.

I think it is the best plan, however, for each to continue manufacturing his own class of fabrics. In this way rivalry would cease to take such a prominent place and better prices could probably be obtained with less cost to manufacture. We have made rapid progress in the last fifteen years in weaving, especially in the fine and fancy fabrics. This is due to our textile schools, which are planting seeds which will bring forth rich fruit, which will enable this country to successfully compete with foreign countries in all varieties of beautiful goods. Europe, through her textile schools, has brought the industry in that country to its present standing, and the United States can do the same, and I hope will soon lead the world in the manufacture of all kinds of goods.

The paper on "Ring Spinning", read at the Boston meeting by Mr. ALFRED E. ADAMS, Whitinsville, Mass., was taken up for discussion.

Mr. JOHN W. PEAD. When I assented to the request of the Secretary to take part in the discussion of Mr. ADAMS' paper on ring spinning, I did not know what I was undertaking, as I was not at the spring meeting and had not received a copy of the Transactions. Mr. ADAMS covered the ground so well that I think we may accept his statements with but little criticism.

There is no question as to the necessity of thoroughly good workmanship on a spinning frame, from the designing room to the erecting and adjusting in the mill, and constant watchfulness should be exercised afterward, to correct changes due to shrinking and springing of floors, and, in a new mill, the settling of piers and walls. For, however careful we may be, they will take place to a greater or less degree. We may be ever so careful to level the first row of frames, say next the wall, and the weight of the second and third rows will spring the floor so as to throw the first row out of level.

We use great care to plumb the spindles, then put on the bands and probably draw them out of plumb, and possibly spring the rails as well. Perfection may never be attained, but we should try and come as near it as possible in making the necessary adjustments. Referring to ring holders, there are advantages in the solid over the plate holder; but in the mills of the Merrimack Company we have close on 100,000 double adjustable rings in the plate holders, which have been in use — most of them from 18 to 20 years, and they give us but little trouble. I would never adopt the three-screwed holder for the purpose of trueing imperfect rings.

After insisting on having a frame perfect in design, workmanship and adjustment, why accept an imperfect ring? All ring makers guarantee their rings, and, as Mr. THOMAS suggested at the spring meeting, all imperfect ones should be returned.

Mr. ADAMS favors the independent kink arrester, and points out the objection to the long tailed guide; but on frames where

the number of yarn is changed frequently, the independent arresters are troublesome, in that they need to be re-adjusted. In changing back and forth from 28s to 55s and intermediate numbers, we could only adjust them by bending, and so many broke we discarded them and rely on the long tailed guide, except on 15 frames of 208 spindles each, running 9,000 revolutions, where the spindle blades are so long that they project a half inch above the top of the bobbin. These are the best kink arresters we have ever found, and are always in adjustment.

I am greatly interested in the statement regarding the number of rolls used per year, which is so small as to be almost incredible; and the same may be said of the number of bands.

The cost of travelers depends so much on how many are wasted — probably many more being dropped on the floor than are put on the rings — that it may be unfair to make comparisons, as the quality of help enters to a considerable extent. And we have just been having an experience where someone, bent on mischief, has cleaned the cups out during the noon hour. This has happened repeatedly at irregular intervals, and as yet we have been unable to detect the culprit.

Knowing what may be done, we can try and keep the consumption as near as possible to that recorded. We have used in one mill, most of the time, on No. 28 yarn—though for three years we have had a portion of the spindles on No. 6 and No. 9, correction being made for lost time—the number of travelers recorded below:

24,248 spindles; 9,000 revolutions; No. 28 yarn.

Six months ending		November,	1889,	841,000	1,480,000
"	"	May,	1890,	639,000	1,302,000
"	"	November,	1890,	663,000	
Year,	"	"	1891,		1,201,000
"	"	"	1892,		705,000
"	"	"	1893,		660,000
"	"	"	1894,		808,000
"	"	"	1895,		934,000
"	"	"	1896,		1,230,000
"	"	"	1897,		1,280,000

The rings, 1⅝-inch, have been used eight years with Sawyer spindles, running 6,700 revolutions; when, in 1889, Rabbeth spindles were put in the old frames, the rings being double flanged, were turned over; a few scattering ones had no doubt been turned before.

For two or three years the rings have been badly worn and we are about replacing them, having delayed to satisfy ourselves as to the advisability of replacing them with 2-inch rings.

I believe we are getting travelers equal at least to any we have ever used, and think if we had to use such as were usually furnished us when we were running 6,500 to 7,000 revolutions, we would be in despair.

I note a reduction of 36 per cent. in case of Mill No. 1, of Mr. ADAMS' Table No. 1, in year 1893, as compared with the four previous years, and 30 per cent. as compared with 1892. I cannot believe that this was due to an improved condition of the rings, as I think the greatest difference, everything else being equal, will be between the first and third years of the life of a ring; but the table I present shows a sharp difference after two and a half years' use, which I cannot satisfactorily account for, the increase since 1893 being due to the rings becoming worn and uneven.

In Table No. 2, Mill No. 1, there is a greater difference between the second and third year than either first and second or third and fourth.

I would like an opinion as to the proper distance from top of traverse to guide, for best results on, say, 2-inch ring, spinning No. 28 yarn, spindle making 9,000 revolutions.

With 1⅝-inch rings, 5½-inch traverse, we believed 2¾-inch to 3-inch about right from top of bobbin to thread guide. When experimenting with 2-inch rings, 7-inch traverse, the travelers came off so badly we could hardly run the frames. We dropped the thread board to 2¼ inches and the change for the better was unmistakable.

We also kept account of the ends broken, for 108 hours, with guides set but 1⅝-inch from top of bobbin, and found that it

averaged six ends per 100 spindles per hour. With the guide 3 inches above the bobbin, 14 ends broke per 100 spindles per hour.

I would also ask if many of the members think it necessary to clean out the bases of Rabbeth spindles? About once in three years we go over our 100,000 spindles, and with a squirt-gun force clean oil into top of bolsters, first attaching a rubber tube to the oil spout; the lower end of the tube being in a pail or can which catches the oil which is saved and filtered, so but little oil is required. Though our spindles are oiled by oilers once in three weeks, we find the oil in the bases very dirty, with a large quantity of black sediment in it. At the same time bolsters are examined, wicks repaired or renewed, blades and necks of the steel rollers examined, and all re-adjusted. This takes considerable time, and costs about 60 cents per 100 spindles. The regular help are required to attend to anything needing re-adjusting, as soon as discovered. The examination mentioned is a general overhauling. Are we over particular? And is the money so spent wholly, or in part, wasted?

How often should 49D Rabbeth spindles, running 9,000 turns, be oiled? We commenced once in four weeks, and gradually reduced to every two weeks, and could see no difference, but settled on once in three weeks as safe.

Mr. IRA J. MARTIN. As our topic is "Ring Spinning", it seems to me that it would be well if we could spend a few moments in the discussion of the frame itself. Trusting that I may provoke a discussion along this line I shall briefly give you my ideas of a new frame. Were I to purchase frames for spinning number 30 warp yarn, I would have them 39 inches wide, with about 240 spindles each. The driving pulley should be at least 12 inches in diameter, with 2-inch face, and the loose pulley ¼-inch smaller in diameter. The cylinder should be 7 inches in diameter and have four bearings. I would have four ring rails and eight lifting rods on each side of frame. I would

have the ring rails bored for 2-inch rings and have them fitted with 1¾-inch double rings, cast-iron holders with the 3-screw adjustment. For a separator I would use the Rhoades-Chandler, with 3½ or 4-inch blade. Would have the Draper No. 2 spindle and 6-inch traverse. The bobbins should be ⅞ of an inch in diameter, counter-bored at the top, with a steel ring at the bottom, and be oiled and shellaced. The cloth on top clearers should be made endless and put on with wires. The under-clearers should be hung on weights instead of springs.

The frames should have some good thread board lifter. The steel rolls should have a space of ½ or ⅝ of an inch between the bearings, and the flutes on each side of the bearings to prevent the laps working into the bearings when an end breaks and winds around the steel rolls. The top rolls should be a little shorter than the flutes on the steel rolls, and the ends of the top rolls ought to project above the cap bar about one-third of its diameter, where it enters the cap bar. Rolls made in this manner may be kept clean without a picker. If pickers must be used they should be made of brass.

The cloth used in covering top rolls should be heavy enough to form a cushion and the skin put on not too tight. With steel rolls sharp and in good condition, top rolls well covered, good results may be obtained with long boss rolls weighted at 28 pounds. Great care, however, should be taken to keep stirrups in the proper place on the saddles and the levers in a horizontal position. A slight variation in either will change the weight on the roll and may cause trouble. My experience has been that no matter how good a roll coverer you may have, you cannot take too much pains to keep him so.

For a saddle I prefer Dixon's latest. I agree with Mr. ADAMS, that the spindle base in new frames should be a close fit in the rail.

If a spindle is found out of plumb it should be examined to see whether the difficulty is in the packing before putting paper under the side of the spindle base.

The bands should always be put on and the spindles run

several hours before the rings are set. The rings should be set with the spindles running. In this way you get the ring concentric with the spindle under working conditions.

All rings should be examined before being set, to ascertain whether they are out of round enough to cause trouble, and if any are found they should be replaced. In banding new frames it is better to have two hands, one on each side of the frame, and they should keep nearly opposite each other. If many bands are put on one side without a corresponding number on the opposite side, it causes a strain upon the cylinder and is liable to injure it.

I have made many experiments trying to get a band that would not stretch, but not until a short time ago did I meet with any satisfactory degree of success. Recently I made some 3½ hank roving, having about 3 turns twist. Six of these rovings were twisted together, the same way as the twist in the roving about 6½ turns per inch, the last twist being about 4 turns per inch. One hundred and forty of these bands weigh a pound. They were made three different ways. First, I made 2 bands with a pull on the loop of 3½ pounds, 2 with a pull of 7 pounds, and 2 with a pull of 14 pounds. They were then hung up by the loops and a 2½-pound weight attached to the other end, and after being in position for thirty seconds the position of the weight was marked. The bands were allowed to remain in this position for one week when the position of the weight was again marked.

The difference between the two marks would show how much each band had stretched. I found that the bands made with a pull on the loop of 14 pounds, stretched only ¼ of an inch, while those made with only 3½ pounds pull stretched 1¾ inches.

I then obtained bands from quite a number of mills and tested them in the same manner with the result that the stretch varied from 1½ to 1¾ inches. From these tests I am led to believe that a band can be made and run with a pull of 1½ pounds, that will do good work. If this can be accomplished it would amount to more than appears at the first glance.

We talk about running bands with a pull of 2½ or 3 pounds, but go into the room some Saturday, after all are out, with a band scale and test a few that have been put on the same day, and if you have never made the test you will be surprised.

Bands stretch so much that unless they are put on with a pull far in excess of 2½ pounds, they soon become loose and then the overseer takes the band boy to task and he gives them an extra pull to be sure and get them tight enough. Unless the bands stretch less than any I have tested it cannot be avoided. Bands should be put on with frames running. I expect that many will take exception to that, but I believe the only way to get production is to keep the belts on the tight pulleys.

With a good system frames should be stopped only to doff and brush the separators. Broken bobbins, floor waste, lap waste, in short, nothing should be taken from the room without first being inspected by the overseer or second-hand.

Every mill should have a room with a good lock on the door, and all change gears belonging to the mill should be kept there. If the superintendent's time is occupied so much that he cannot attend to giving out the gears when necessary, it may be left with the master mechanic, or the one who gives out the supplies might attend to it. In either case they should only be given out upon an order from the overseer approved by the superintendent.

A careful record should be kept of all gears that go out of the room and the master mechanic should never give out a new gear for repairs without receiving an old one in return. Some may say that it is not necessary, as they have honest and reliable overseers. My reply is, keep them so.

A man to be a successful overseer should be dissatisfied. That is, he should strive every day to improve on the preceding day, and should never be satisfied with a thousand pounds when a thousand and one may be had. The motto should be more and better, first, last and all the time. He should never be satisfied to allow anything to go wrong and wait for tomorrow before correcting it. It should be attended to at once, even if

he does not get washed up before bell time. To overcome obstacles by hard work is better than a good excuse. Promptness is a virtue and even in cotton manufacturing has its reward.

Mr. EDWARD ATKINSON. In the discussion of the paper upon the spinning frame I was greatly interested, but I venture to recall the facts which were developed, notably by Mr. WOODBURY, during our experiments on the subject of lubrication. If you will look back over the records of this Assocaition you will find the full report.* You will find that when we began almost every agent thought he had the best oil and that he comprehended the subject very fully. I, myself, knew less, but I had been startled by the dangers of fires both from hot bearings and volatile mineral oils. I therefore called upon a hundred members, assigning to each a number, to give me all the details of the use of oil — the price, the quantity and the cost per unit of product, with the name and description of the oil. When these reports were tabulated — of which fifty-five or thereabouts should have been alike — there was a variation of 250 per cent. on every element — price, quantity and cost — and there was no rule that could be derived even from the variation.† In fact, it proved that none of us knew anything about the subject of lubrication or the quality of oil.

We then proceeded to get the co-efficient of friction. We tested every existing machine that had been invented for that purpose. There was not one that was worth the metal of which it was made. They yielded different results with the window open near the machine, or the window shut. They yielded different results under different conditions of temperature.

Professor ORDWAY designed a machine for the purpose of determining the wearing qualities of oil by testing the lubricant between two annular revolving surfaces which were on upright shafts, and the quality of the results was due to the fact that

*Transactions, New England Cotton Manufacturers' Association, Vol. 28.

†Transactions, New England Cotton Manufacturers' Association, Vol. 25.

Professor ORDWAY placed these shafts out of line with each other so that the surfaces did not wear grooves upon each other.

Mr. WOODBURY then added to this type of machine by introducing devices for exactly measuring the temperature of the bearing and also the co-efficient of friction at various temperatures.

It then became necessary for me to threaten the Standard Oil Company to cut off their sales of lubricating oils unless they improved their methods, before we succeeded in bringing this matter to a science. The end was a very large reduction in the cost of oil and the establishment of practically uniform rules in its application, although much may yet remain to be accomplished. You will find that table and this whole discussion in your back numbers.

In the course of that investigation we made use of a model ring spinning frame. Mr. WOODBURY observed and tabulated an apparent law of vibration or rythm.‡ The vibration of every part of the frame would rise on a curve to a certain point, then diminish and then rise again. This was continuous. Now every one of those changes implies wear, friction and waste. I then made the suggestion that a block of hard wood should be inserted in every spinning frame to cut off the spindle rail or the ring rail or each of the operating parts of the machine from the frame, and I am surprised that no action has been taken to that end. You will recall the fact that the rails of the Lowell Railroad were laid on stone sleepers — an example of the danger of subjecting metals to uniform vibration or to rigid attachments. Mr. A. T. STEWART once had a woolen mill built in which all the machinery was fastened to iron girders. It became impossible to operate it and no success was attained until a New England man was sent for who interposed a plank floor between the iron beams and machinery. After that there was no difficulty in working the mill. You may also note the common custom of placing electric motors on pieces of felt. [After this

‡Transactions, New England Cotton Manufacturers' Association, Vol. 27, p. 60.

meeting a member from Canada informed me that he had stopped the vibration in a dynamo machine by putting sheet lead between the operating parts of the machine and some of the members.]

Again, during these experiments upon oil I devised a compensation band,§ which was made, as I remember, two-thirds cotton, one-third flax, braided. The humidity which extends the cotton shrinks the flax. Thus we had a compensation balance. We tested that banding against every other kind that could be made or was in use, and while equal lengths under the same tension stretched from one to four inches, as I recall the figures, the compensation band stretched less than one inch. The fault was in the size and hardness of the knot. I ought to have patented it and then sold my patent to Mr. DRAPER. There would then have been no other banding fit to be used. That is the way the Messrs. DRAPER have benefitted the cotton manufacture.

But I venture now to ask why all the attention is given to the finer points in the construction of the frame, thereafter to be put at the mercy of every band boy in each mill? There is greater room for invention in establishing uniform band tension than there is in overcoming the unequal vibration of the frame.

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§Transactions, New England Cotton Manufacturers' Association, Vol. 26, p. 39.

FOURTH SESSION.

THURSDAY, OCTOBER 28, 1897, 9.30 A. M., AT THE PHILADELPHIA TEXTILE SCHOOL.

President RUSSELL W. EATON in the chair.

The PRESIDENT. The first paper at this session is by Mr. GEORGE OTIS DRAPER, of Hopedale, Mass.

POWER TESTING ON FRAME SPINDLES.

GEORGE OTIS DRAPER, *Secretary of the Draper Company,*
Hopedale, Mass.

ELEMENTS OF POWER CONSUMPTION.

The spindle of commerce, as known at the present day, consists in an highly perfected structure evolved by a continuous improvement representing about forty years of experimenting. When reduced to lowest terms it must be considered simply as an upright revolving shaft.

The modifications in detail, however, have made this particular class of shaft peculiar, in allowing it to run steadily at a higher speed than any other mechanical structure known, which is used in large numbers.

The elements of power consumption are of course similar, whatever the type of spindle. Their proportion, however, varies so widely with different forms, that it is necessary to determine the absolute influence of each separately.

The consumption of power by a revolving body is a problem involving the laws of friction as affected by pressure, centrifugal force and speed. The elements producing friction in this case are as follows:

In the first place, the spindle shaft itself is necessarily somewhat imperfect. Measured by an infinitesimal scale it would be found to be crooked, out of round, eccentric and of rough surface. Its bearings are of course similarly defective.

The load carried by it, while performing work, consisting of the bobbin and yarn, is unsymmetrical in outline and of rough surface, producing air resistance, and is uneven in distribution of weight, causing the centre of gravity to be more or less on one side of the axis. This develops a centrifugal force, increasing the bearing friction, also increasing the air resistance, by the gyration which it may cause.

The pull of the traveler caused by air resistance, and the friction of the traveler itself on the ring, also add considerable work, acting as a brake or retarding force.

The pull of the band adds to the lateral friction, in the bearings, and the oil, or lubricant used, varies the co-efficient of friction.

These different elements of power vary with the quality of work performed by the spindle, its speed of rotation, and its design or construction. The work required is of course independent of the spindle itself, as it is regulated by the amount of weight to be carried, and the amount of drag on the traveler. The speed should not only increase the power in proportion to the amount of work accomplished, but according to physical laws, should increase certain power elements by the square of the velocity, namely, those governed by the eccentricity of the moving parts.

Here, however, we encounter one of the perplexing features of the modern type of spindle, as its use of yielding bearings allows the speed to be increased without apparently increasing the vibration. Theoretically, the spindle should gyrate in proportion to its speed, but the self-centering type, so called, is apparently independent of velocity in this respect, as it will run smoothly with loads known to be out of balance, and even run steadier at certain high speeds than at lower velocity. The reason for this action has never yet been satisfactorily explained. Each spindle law-suit has usually developed a new expert theory. One claims that the spindle itself can assume the axis of gravitation of its load by being free in its bearings, in spite of the fact that the spindle manifestly cannot move within its

load. Others claim that the yielding bearings allow a cushioning effect which absorbs the violent intermittent movements produced by the revolution of the unbalanced load. A third theory explains that while the spindle runs steadily at the top, the foot confined by the yielding bearings has a vibration, thereby changing the point of gyration and utilizing the looseness of the bearings which has been found necessary. Whatever the theory, the fact remains that simple changes in design greatly affect the power consumed by the spindle itself. The same shaft with the same band tension and oil can vary in power according to the design of the bearings, and their mechanical relations to each other.

The principal element of power consumption in a spindle is usually the amount of lateral friction due to the tension of the band. In present practice, this force pressing the spindle against its bearing, is equal to a direct pull, varying from a quarter of a pound to, perhaps, eight pounds.

In earlier years, when heavier spindles were used, and also larger bands, the tension sometimes ran up to sixteen pounds. The average band pull on a frame in the usual mill is probably between two and four pounds, although one pound would be ample for ordinary conditions if constantly maintained. As bands are greatly affected by difference in temperature and moisture, the usual tension has to be high enough to allow variation.

The other important factor of power in the naked spindle is the bearing friction due to the lateral pressure from the centrifugal force developed by the uneven mass of the revolving structure. The air resistance of the smooth metal parts must be trifling.

The factor next in importance is usually the drag effect of the traveler pull, especially when spinning coarse yarns. This consumes a large amount of power, and varies with the size of the yarn being spun, the amount of twist, and the speed of the spindle. The amount of drag is adjusted by the weight of the

traveler, and is therefore independent of any modification in the spindle itself.

Another element is the weight or load carried by the spindle. This varies the vertical friction on the vertical support, which, however, is not important. The increase of power noted as weight is added is mainly due to the centrifugal force developed by the increasing unevenness of the load which multiplies the lateral bearing friction. The air resistance is also an important factor, as the yarn surface is rough and unevenly distributed.

Taking these elements into consideration, it is known from actual experience that yielding bearings are absolutely necessary for modern high speeds, as rigid bearings increase vibration to an impractical extent. The degree of yield, however, is governed by other matters than power consumption. For power purposes it might be advisable to have considerable yield, but as it is necessary to keep the spindle practically in the center of the ring, only a trifling degree of movement is possible, the usual limits being from five to ten thousandths of an inch variation in the fit between the bolster and its support.

The friction in the bearings themselves can of course be modified by the manner of fit and the method of lubrication. A loose fit lessens the power required, unless it affects the steadiness of the spindle. The lubrication is vital, as if proper oiling methods are not used, the bearings will become dry, causing the spindle to heat and stick. The lubricant itself may have an important effect, as tests have shown that certain low gravity oils commonly used add an unnecessary increase to the power. A thick, heavy oil necessarily interferes with the rapid motion of the spindle in the same way that a muddy road interferes with the progress of a team. A thin, light oil greatly reduces the power, and is still sufficient to prevent wear and heating.

Having noticed the various elements consuming power, it is next pertinent to suggest, if possible, how they can be reduced in evil effect.

The band pull appears to be an easy problem, but in reality

is very difficult of solution. Bands are made of pliable yarn or roving which is capable of great stretch, and constantly affected by changes in humidity. Not only are they affected by moisture in the air, but they also absorb oil thrown out by the spindles, and are liable to considerable contraction merely from resting between periods of work. When a frame is started up in the morning it can easily consume over 10 per cent. more power than when the bands have stretched by a few hours' running. A slight rain storm can also put the power up over 10 per cent. during the day. The boys who tie on the bands are rarely held accountable for getting them too tight and the incentive is always in the wrong direction, as they are responsible for any troubles arising from too slack bands. The spinning overseer also naturally has little concern in the amount of power used in the engine room when it does not show in his own cost of production. The prevention of a little slack yarn is often accomplished at the cost of tons of coal and years of wear. The general evils of the banding system can probably only be cured by an entirely new method of application or new construction or substance in the bands themselves. Peculiar systems of banding have actually been tried in which the band pull was reduced to not over half a pound on the average. Incidental disadvantages or unreasonable predjudice has, however, prevented universal use.

Referring to the traveler pull, it is evident that a certain amount is necessary to wind the yarn on the bobbin. The only way, therefore, to reduce the general amount taken is to have the spindles properly centered and the guide wires in proper position so that no spindle will have more work than is necessary. It is also important to keep the travelers free from lint, as this makes an additional drag. When the rings are out of position they very probably cause the yarn delivered to the bobbin to wind in a non-uniform manner, increasing the centrifugal effect.

Coming to the spindle itself, it is first essential to have the shaft perfectly straight, as any crook will multiply the bearing

friction and the air resistance. It should also be proportioned so that it will not be bent by any handling or strain that it is liable to in use. Spindles have been used in large numbers that consumed power in excess simply because of the intermittent bending they were subject to, on account of their too slight structure. The friction of the shaft in its bearing will of course vary with the diameter, yet experience shows that it is safer to use a large shaft that will not bend rather than try to reduce power by approaching the danger line of bending strain with a small bearing section.

The spindle most universally known today allows a small average bearing section by use of a tapering pintle, together with a maximum strength near the bending point.

A loose fit, as before stated, will save power although sometimes at the expense of good running. The usual practice in modern spindles which have an adjustable fit, is to send them out closely fitted, as they are sure to run steadier in this manner, more surely meeting the approval of the purchaser. They will therefore use less power later by wearing themselves a more liberal fit.

The question of material seems to be of little moment. The usual cast-iron bearing is as good for a steel shaft as any other metal, although brass and German silver have been used with certain former structures.

The question of workmanship in every part of the spindle is vital necessarily. After determining the proper proportion of parts and using every care in manufacture, it is essential to gauge with unusual minuteness so that every spindle shall have the utmost advantage of the experience which has determined the proportions. After the spindle has left the shop and entered the mill, there are new elements affecting the power, such as the improvement in the surface of the bearings which can only result from running. Not only is the roughness of the cut metal worn smooth, but each eccentric section of the turning shaft plows a path that frees the binding restraint of the parts. Spindles after a year's running show considerable reduction in

power, other things being equal. To offset this improvement is another element of a dangerous character, consisting in the dirt or sediment made chiefly by the iron ground out from the bearings. Part of it is also due to the sediment contained in the oil, which varies in importance with the grade of oil used. Spindles that are not properly oiled, and run partly dry, grind out a great deal of iron at times. This dirt, whatever its nature, has a bad effect, as it naturally thickens the lubricant, thereby consuming power. It can be prevented by liberal use of oil at the start, when the wear is most serious, thereby flooding it out. The only other method is to remove the spindle and bearings, and clean the base with a suction pump or swab. Cleaning spindles is a frequent custom in England, but has never been taken up in this country to any marked extent. It probably is not necessary in mills which use clear light oil and plenty of it.

Now that the various divisions of power consumption have been defined, it might be interesting to look back over the records of former experience to note what progress has been made toward determining the relative importance of each.

STATE OF THE ART.

In the history of spindle tests the only printed records known to the writer are those embodied in the New England Cotton Manufacturers' reports and certain records made for cotton mills and machinery builders.

Taking a glance through the Cotton Manufacturers' records certain important information is found, briefly quoted as follows:

The first reference to the power of a spinning frame is in report No. 9 of meeting dated October 19, 1870. On page 9, ring spindles are quoted at "102 spindles to the horse power on No. 32 yarn at 5,900 revolutions." This refers, evidently, to what was known as the common spindle. On page 10 of report No. 10 of meeting dated April 19, 1871, it is shown that the traveler pull in a certain instance took from 12 to 15 per cent.

of the total power and the spindles required from two-thirds to three-fourths of the power.

On page 52 of report No. 10 is a table showing power required by Sawyer spindles in comparison with older forms. As many such tables follow in the next few years it might as well be stated here as at any time, that for purposes of modern comparison they are practically worthless, as all these earlier tests were made without the slightest knowledge as to what the tension of the bands was, and there is also no record of the kind of oil used.

The tension of the bands being much higher and more irregular than at present, could easily make these records vary up to 50 per cent. or even more, while the oil itself could easily make 10 per cent. variation. These old frames also were probably inferior to the modern mechanism, in many respects affecting the power. It was impossibie to know the band tension as a proper instrument for weighing it had not then been invented.

Report No. 11 has a few figures of power tests also.

On page 29 of report No. 12 of meeting dated April 17, 1872, is another table of power tests with various others following in the next few pages.

On page 15 of report No. 13 of meeting dated October 16, 1872, are some tests of power under various banding conditions. They unfortunately have no diagram showing the different methods of banding, but the difference in horse power by various bandings simply proves what has been found in modern experience, namely, that the variation in band pull has a vital effect, over 20 per cent. in net power consumed by the frame being gained here by one system over another. It must be realized in order to appreciate such a subject, that when 20 per cent. in net spinning results is gained, it means a much higher percentage on the difference of power required by the spindles themselves.

On page 16 of report No. 14 of meeting dated April 16, 1873, the oil question appears to have been first mentioned. A gain is recorded by the use of Downer's spindle oil over some other.

On this same page the question of consuming power by run-

ning in oil is referred to, and water seems to be suggested as a lubricant. As water is of a much greater gravity than good spindle oil, there is no possible advantage in its use, even if it were a lubricant.

Power tests follow on pages 18 and 19.

On page 19 Mr. WEBBER mentions a method of obtaining the speed of spindles by figuring. Here is another chance for error as compared with modern practice. The present custom, which should be universally followed, is to attach a speed counter directly to the spindle itself, by means of a rubber tube connection. In this way the speed is absolutely known, while any figuring process is sure to result in more or less error. On page 24 are some interesting figures showing variations due to changes in speed. By plotting a curve it can be shown that the variation is quite uniform.

On the next page is a communication from GEORGE DRAPER, in which he calls attention to the fact that the usual power test is not fair to the spindles from including elements which have nothing to do with them. He advises tests made with spindles run without the rest of the frame, tested with full and empty bobbins. He says, on page 26, "By testing the cylinders and spindles alone you get rid of a great variety of difficulties in comparing one frame with another. The power required to drive different frames is varied by so many circumstances outside the spindles that only an expert knowing all the facts can judge between them."

On page 27 Mr. BARTON JENKS says he was the first person who ever tested separately the power required to drive the different parts of various machines.

On page 28 Mr. WEBBER gives a table of spindle tests reduced to the uniform velocity of 6,000 revolutions, but does not give the process by which the reduction is figured.

On page 21 of report No. 15 of meeting held October 15, 1873, Mr. WEBBER says, "I have said that the only proper way to make a test is to make it at the same mill, under the same management and under the same circumstances, and that under

different circumstances it is no test at all. That will account for all the differences which I have found in the Sawyer spindle, and they have been very great."

On page 23 Mr. WEBBER quotes a test where a reduction in the weight of the spindle did not reduce the power. Very probably the reduction in weight allowed the spindle to vibrate by not being stiff enough.

On page 25 Mr. SAWYER says as follows: "I cannot see how any conclusive experiments can be made until same means are given to find the exact tension of the band. I have seen two frames made in the same shop, running side by side, and yet the power varied because the bands were lighter in one case than in the other, I suppose one required twice as much force as the other, and this shows that the tension of the band is an important element, which must be taken into account if you are to rely on any one experiment, but if you are to take the mean of a great number of experiments then you may take them as they run."

On page 40 is a table of comparative tests between the Pearl, Sawyer and Rabbeth models by Mr. WEBBER.

After report No. 16 of meeting held April 15, 1874, is a most elaborate series of power tests made by SAMUEL WEBBER. They cover all the spindles then known to the trade, and each spindle has a variety of tests made in different mills and on different yarns. There is no record of band tension or oil used except that certain minutes are entered saying that the bands are too tight, new or old, etc. Some of the tests included have been mentioned in the previous reports.

For several years after this date the question of power on spindles seems to have lost interest, as nothing further is entered until record No. 26 of meeting held April 30, 1879. On page 41 Mr. C. J. H. WOODBURY raises the question of the band tension and makes some very pertinent remarks. He states that for purposes of experiment variation in tension must be eliminated by reducing the tension to the proper amount. More power could be saved than is gained by the use of any one

trade spindle over another. He reports finding variations from one to 16 pounds. Mr. GEORGE DRAPER, on page 48, goes into the question in a very elaborate manner, stating that the power tests taken seven or eight years ago were very contradictory, as with the same frame a change in the style of banding made 36 per cent. variation in power. He mentions the invention of the band scale, which has since been used to great advantage. He reports finding the average band pull on one frame two and a half pounds and on another four and eight-tenths pounds.

On pages 74 and 75 are various records of the stretch of spindle bands made with different fibres.

In report No. 28 of meeting held April 28, 1880, the question of oil tests is gone into at length and certain experiments of Mr. WOODBURY'S are given, showing the relation of the co-efficient of friction to the pressure exerted.

On page 63 Mr. GEORGE DRAPER gives results of testing a frame with bands of various tensions, which show a practically uniform increase of power as the band pull rises. A change from two pounds to three pounds in band tension is shown to make a difference of 17 per cent. in power required for the whole frame. As the increase in band tension has nothing to do with many of the elements included in the total power, it is probable that an actual increase in power on the spindles themselves might have been nearly twice that amount. In fact, later tests have actually shown a variation of 30 per cent. on the spindles themselves by an increase of one pound in the average band tension. In the following pages are some interesting results obtained by testing various trade oils, but they have no value today, when the oils known are of different names and different mixtures.

On page 68 Professor WHITTAKER states that the power consumed in driving a spindle may be divided into three portions, one of which, the resistance to the surrounding air, increases nearly as the square of the velocity, causing the total power

consumed in spinning to increase more rapidly than the velocity of spinning.

The lull of the interest in power tests during this period is undoubtedly due to the fact that the Sawyer spindle, by superseding all other trade forms, left the question of comparison unnecessary.

In report No. 38 of meeting held April 29, 1885, on page 49 there starts a paper by Prof. CHANNING WHITTAKER on power tests, in which he refers to tests made in 1880, at Lonsdale, R. I., giving extracts from the same. He also gives figures of power tests on the new Rabbeth spindles, which were the first so-called self-centering style. The latter tests appear to be the first on record in these reports where the band tension was weighed. Unfortunately the test of the bands was unsatisfactory, as the method of reducing tension was by stretching the bands, and it was found that they would not stay stretched. It was, therefore, a matter of conjecture at times just what the band pull was. Mr. WHITTAKER found, as might be expected, that the variation in tension produced important results, over 20 per cent. being noticed between two of the tests.

Later, on page 64, a change in banding made a difference of over 55 per cent.

In report No. 41 of meeting held October 27, 1886, is an interesting paper started on page 14, on a new method of banding spindles. The inventor of the process fully appreciates the disadvantages of tight bands and claims that his system will reduce the band tension to half a pound. He figures that a two-pound band pull requires 20 per cent. of the total power of the frame. It is hard to tell how this is figured, as the total power of the frame often varies from elements that have nothing to do with the bands or spindles. He states on page 23 that on power tests he has never obtained a saving of less than 25 per cent., and has even recorded as high as 40 per cent.

In report No. 44 of meeting held April 25, 1888, is the record of tests made for General DRAPER'S essay on the oil question. These tests were taken with a well known band pull and, while

the elements of power were not divided in this report as detailed as they might have been, they were sufficient for the purposes of this special report. It is not known how generally the public have availed themselves of the facts learned by these tests, but it was shown that it would be possible for the usual mill to save about 10 per cent. of power by using light oil if they wished. When no price is charged for information, it is very probable that it will not accomplish what it might with a selfish interest back of it.

In report No. 49 of meeting held October 29, 1890, are some records of tests by Mr. F. M. MESSENGER, on various oils. These tests are made on spindles banded by the Coggeshall method and it is evident that in comparing the tests with others the variation introduced by the Coggeshall method must be noted. In the former report this variation was referred to as between 25 and 40 per cent., it will be remembered.

In report No. 51 of meeting dated October 28, 1891, is an interesting paper, starting on page 50, on power and speed in cotton mills by Mr. F. P. SHELDON, but it contains no detailed figures of the number of spindles per horse power with stated conditions.

In report No. 52 of meeting held April 27, 1892, is a report of oil tests made by Mr. A. M. GOODALE. There seems to be no record of band tension, although it is stated that the tests were all made on the same frame, which probably means that the same set of bands was used throughout.

In report No. 53 of meeting held October 26, 1892, on page 7, is another series of tests by Mr. GOODALE. These also seem to lack any record of band tension.

In report No. 55 of meeting held October 25, 1893, on page 10 is a record of horse power per spindle for several entire mills. This is interesting, but cannot be figured into showing in detail results on the spindles themselves.

On page 12 is a paper by Mr. A. F. KNIGHT, in which he gives the horse power per spindle of spindles running with dif-

ferent sizes of ring and different lengths of traverse. These are given without any details.

On page 20 he gives further figures on the same subject.

RECORDS OF FORMER TESTS.

In order to present this power test question graphically it has been thought well to tabulate all printed records of well known spindles.

The following list commenced with the N. E. C. M. A. Records, giving them in the order they were presented. Where the same tests are given twice, the first reference alone is presented.

They are not copied exactly, as decimals and fractions are left off for convenience. The average power spinning is the only result entered, as the others are not numerous enough for comparison.

No tests are given where the number of yarn spun was not known. Where several tests were recorded under the same conditions, the highest alone are given. Where different oils are used as in the later tests, the highest result is also given.

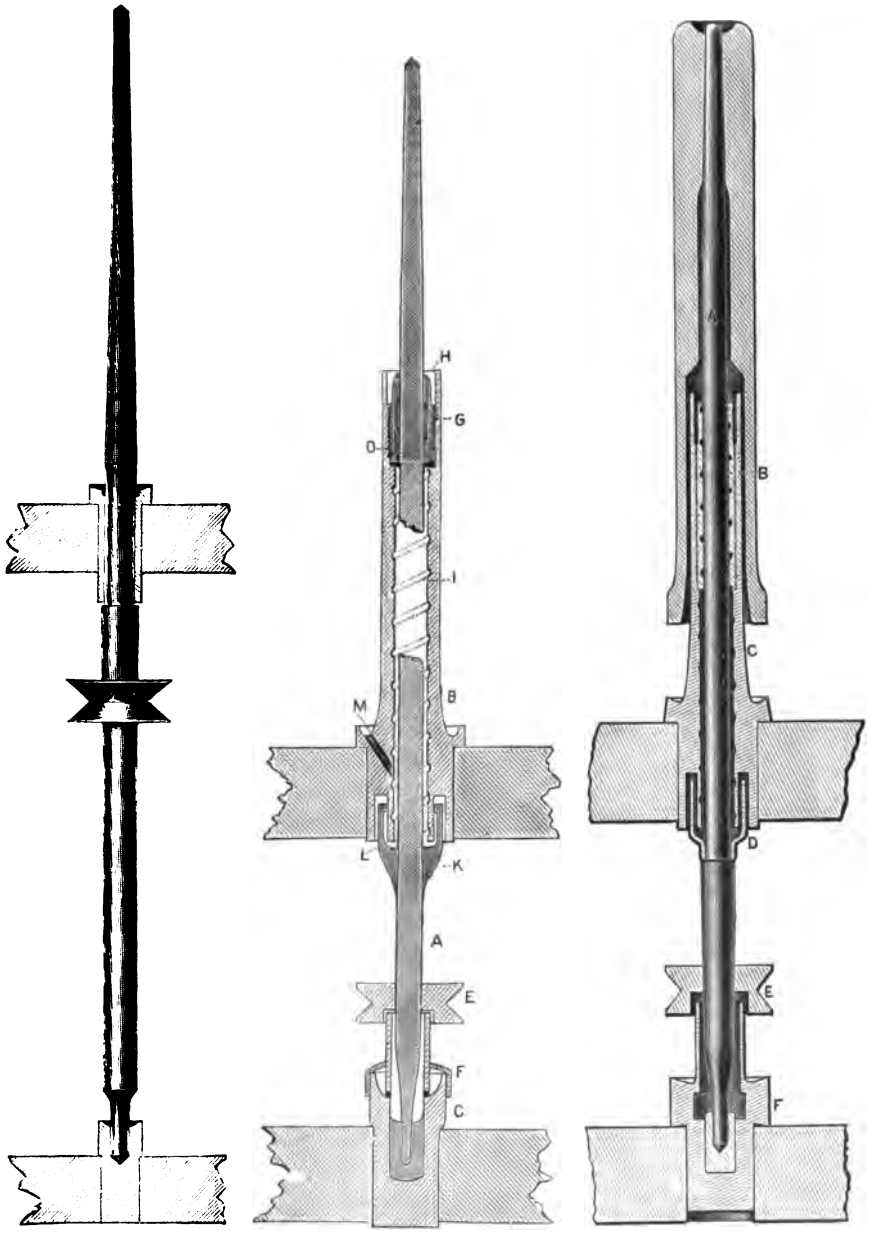
Spindles which were so defective in mechanical features as to have had a limited use, such as the Excelsior, Perry, Pusey, etc., also dead spindles, and throstle frame types, are not included as tending to confuse by irrelevance. The power taken by an impractical structure has no importance in the art.

The spindles mentioned in these tests may be described as follows:

The common spindles were so called by reason of their universal use at the time prior to the patented forms of recent type. They were a two-rail device with short bearings and made very heavy, the usual weight being from 12 to 14 ounces each.

The Sawyer spindle was a modification of the common, in which the upper bearing was lengthened so as to extend within the bobbin, and thus support the spindle opposite the center of of its load. The spindle itself was also made much lighter than the common spindle, and with a reduced bearing section.

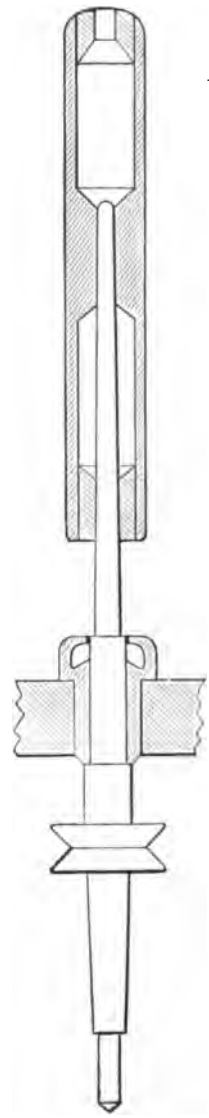
SPINDLES USED IN RECORDED POWER TESTS.



COMMON SPINDLE. EARLY SAWYER. MODIFIED SAWYER.

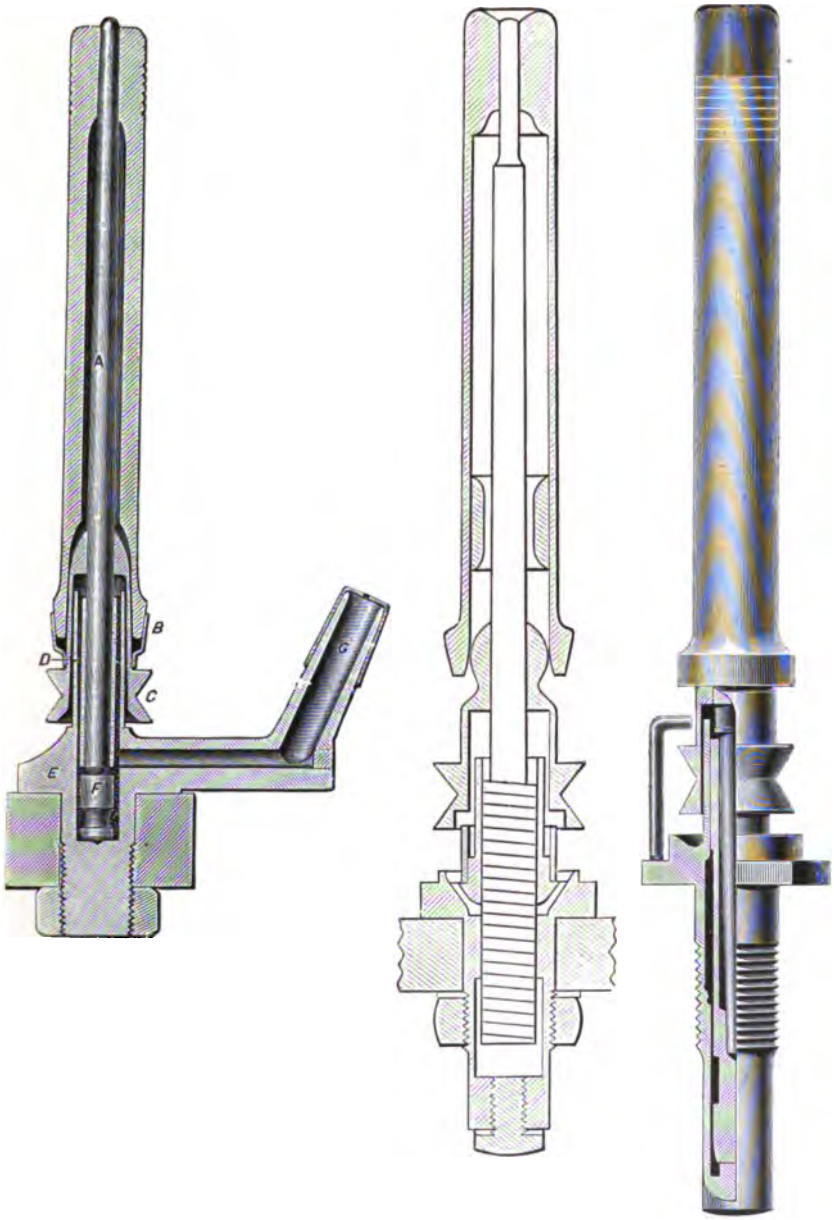
SPINDLES USED IN RECORDED POWER TESTS.

RABBETH SAWYER
OR OLD RABBETH.



PEARL.

SPINDLES USED IN RECORDED POWER TESTS.

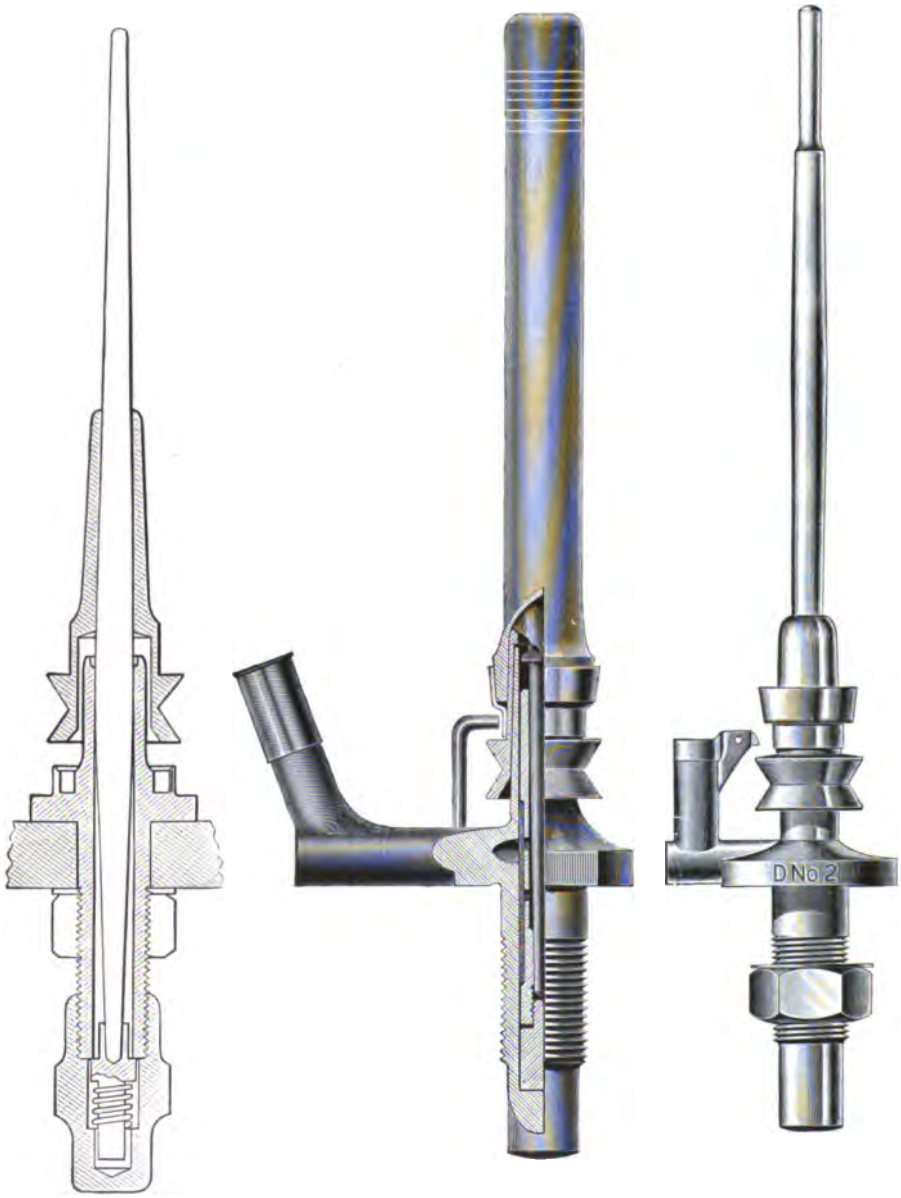


NEW RABBETH.
(First self-centering type.)

EUREKA.

WHITIN.
(As made when tested.)

SPINDLES USED IN RECORDED POWER TESTS.



McMULLAN.
(As made when tested.

49-D RABBETH.

DRAPER.

The modified Sawyer, so called, differed from the early type of Sawyer in having a differently designed shaft, a different oiling arrangement and a different seat for the bobbin.

The old Rabbeth, so called, had no principle in common with the modern Rabbeth structures, except the use of a sleeve-whorl and the attachment to a single rail. It was practically a sleeve-whorl Sawyer running in an oil reservoir.

The Pearl spindle was a type of common, having a very light shaft, with the bearings near together, although in two rails, and carrying the bobbin in such a manner as to have the wood of the bobbin project some distance above the tip of the spindle.

The new Rabbeth spindle, so called, was the early type of yielding bearing structure.

The Eureka spindle was a modification of the same idea in which the yield of the bearing was accomplished by making the bolster a spring.

The Whitin spindle had a form of yielding bearing in which no packing was used.

The McMullan spindle referred to in these tests was a type of modern spindle in which the upper bearing is rigid, and the lower bearing yielding and supported by a spring. The present McMullan spindle is entirely different in design.

None of these tests referred to in these records include the latest form of Rabbeth spindle, which has received the greatest introduction of any known to the trade, made under the names of "49-D" and "Draper," as no results from these types have ever been made public.

The preceding cuts do not show the spindles drawn to a uniform scale, as they are made from electrotypes that were formerly used for various other purposes.

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	Page.	Record No.	Date of Meeting.
Common	325	13	2000	52	10	Apr. 19, 1871
"	195	13	3000	52	10	" " "
"	132	13	4000	52	10	" " "
"	95	13	5000	52	10	" " "
"	74	13	6000	52	10	" " "
Sawyer	493	13	2000	52	10	" " "
"	297	13	3000	52	10	" " "
"	233	13	4000	52	10	" " "
"	150	13	5000	52	10	" " "
"	124	13	6000	52	10	" " "
"	92	13	7000	52	10	" " "
Common	345	30	2000	52	10	" " "
"	210	30	3000	52	10	" " "
"	145	30	4000	52	10	" " "
"	108	30	5000	52	10	" " "
"	84	30	6000	52	10	" " "
Sawyer	539	30	2000	52	10	" " "
"	323	30	3000	52	10	" " "
"	199	30	4000	52	10	" " "
"	169	30	5000	52	10	" " "
"	132	30	6000	52	10	" " "
"	106	30	7000	52	10	" " "
"	85	30	8000	52	10	" " "
Common	107	12	5120	29	12	" 17, 1872
Sawyer	133	12	6050	29	12	" " "
"	155	12	5000	29	12	" " "
"	213	12	4027	29	12	" " "
"	340	12	3055	29	12	" " "
"	147	40	5857	31	12	" " "
"	169	42	7003	31	12	" " "
Old Rabbeth	178	29	5104	18	14	" 16, 1873
Common	102	29	5464	19	14	" " "
Heavy Common	66	30	6000	28	14	" " "
Light Common	90	30	6000	28	14	" " "
Old Rabbeth	134	30	6000	28	14	" " "
Sawyer old bolster	152	40	6000	28	14	" " "
Sawyer new bolster	195	40	6000	28	14	" " "
Sawyer	114	34	6591	33	15	Oct. 15, 1873
Pearl	107	28	6059	40	15	" " "
Sawyer	116	28	6059	40	15	" " "
Old Rabbeth	141	28	6059	40	15	" " "
Common	106	12	4480	24–25	16	Apr. 15, 1874
"	110	28	5100	24–25	16	" " "
"	94	34	5727	24–25	16	" " "
"	97	34F	5066	24–25	16	" " "
"	90	37F	5240	24–25	16	" " "

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	Page.	Rec. No.	Date of Meeting.
Common	101	33	5900	24–25	16	Apr. 15, 1874
"	148	46	5857	24–25	16	" " "
"	90	48	4930	24–25	16	" " "
"	91	30	5010	24–25	16	" " "
"	104	8	2211	24–25	16	" " "
"	95	12	4524	24–25	16	" " "
"	103	12	4255	24–25	16	" " "
"	117	12	3893	24–25	16	" " "
"	136	12	3476	24–25	16	" " "
"	150	12	3200	24–25	16	" " "
"	84	23	5609	24–25	16	" " "
"	97	16	4325	24–25	16	" " "
"	104	9F	3500	24–25	16	" " "
"	108	14F	3800	24–25	16	" " "
"	86	11	4326	24–25	16	" " "
"	100	11	3800	24–25	16	" " "
"	103	14F	3400	24–25	16	" " "
"	86	9	4050	24–25	16	" " "
"	83	17	5067	24–25	16	" " "
"	83	22	5067	24–25	16	" " "
"	108	25	4972	24–25	16	" " "
"	79	28	5240	24–25	16	" " "
"	103	28	5460	24–25	16	" " "
"	107	34	5154	24–25	16	" " "
"	89	34	6187	24–25	16	" " "
"	147	14	3544	24–25	16	" " "
"	80	30	5950	24–25	16	" " "
"	92	41	5950	24–25	16	" " "
"	167	14F	3090	26–27	16	" " "
"	112	14F	4050	26–27	16	" " "
"	67	14F	5672	26–27	16	" " "
"	83	30	6000	26–27	16	" " "
"	78	30	5890	26–27	16	" " "
"	70	30	6356	26–27	16	" " "
"	107	28	4895	26–27	16	" " "
"	87	31	5540	26–27	16	" " "
"	95	31	5380	26–27	16	" " "
"	77	31	6020	26–27	16	" " "
"	88	29	5200	26–27	16	" " "
"	77	28	6059	26–27	16	" " "
"	66	15	5802	26–27	16	" " "
"	66	6	5050	28–29	16	" " "
"	77	12	5050	28–29	16	" " "
Sawyer	232	13F	4027	28–29	16	" " "
"	96	12	5605	28–29	16	" " "

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	Page.	Rec. No.	Date of Meeting.
Sawyer	130	12	5069	28–29	16	Apr. 15, 1874
"	158	12	4386	28–29	16	" " "
"	180	12	3753	28–29	16	" " "
"	156	12	4180	28–29	16	" " "
"	118	12	4900	28–29	16	" " "
"	105	12	5320	28–29	16	" " "
"	80	12	6320	28–29	16	" " "
"	145	12	4600	28–29	16	" " "
"	115	12	5230	28–29	16	" " "
"	95	12	5770	28–29	16	" " "
"	78	12	6350	28–29	16	" " "
"	122	28	6002	28–29	16	" " "
"	129	12	5290	28–29	16	" " "
"	143	40	6260	28–29	16	" " "
"	125	32	6448	28–29	16	" " "
"	121	28	6059	30–31	16	" " "
"	150	15	5820	30–31	16	" " "
Old Rabbeth	116	30	6100	30–31	16	" " "
Pearl	141	28	6059	30–31	16	" " "
"	134	20	5719	32–33	16	" " "
"	107	14	5285	32–33	16	" " "
"	110	15	5488	32–33	16	" " "
"	138	28	5488	32–33	16	" " "
"	120	28	5735	32–33	16	" " "
Modified Sawyer	155	28	5413	50	38	" 29, 1885
" "	138	28	5851	50	38	" " "
" "	117	28	6418	50	38	" " "
" "	105	28	6954	50	38	" " "
" "	91	28	7573	50	38	" " "
" "	81	28	8113	50	38	" " "
" "	71	28	8934	50	38	" " "
Common	161	28	5408	51	38	" " "
"	143	28	5842	51	38	" " "
"	122	28	6386	51	38	" " "
"	106	28	6929	51	38	" " "
"	92	28	7539	51	38	" " "
"	82	28	8124	51	38	" " "
"	71	28	8948	51	38	" " "
New Rabbeth	132	19	6609	56	38	" " "
" "	110	19	7039	56	38	" " "
" "	99	19	7976	56	38	" " "
" "	66	19	9081	56	38	" " "
" "	62	19	9947	56	38	" " "
Eureka	92	35	9593	60	38	" " "
"	76	35	9729	60	38	" " "
"	80	35	9851	60	38	" " "

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	Page.	Rec. No.	Date of Meeting.
Eureka	91	35	9940	60	38	Apr. 29, 1885
"	85	35	9955	60	38	" " "
New Rabbeth	103	19	9131	64	38	" " "
Whitin	112	40	9491	21	44	April 25, 1888
"	130	40	8589	21	44	" " "
McMullan	86	30	9100	61	52	" 27, 1892
"	96	40	9100	12	53	Oct. 26, 1892
New Rabbeth	82	28	9100	20	55	" 26, 1892

GROUPING OF TESTS

At Similar Speeds and on Same Number of Yarn.

Kind of Spindles.	Spindles to H. P.	No. of Yarn.	Speed.	Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.
Common	66	6	5050	Common	106	12	4480
				"	95	12	4524
"	104	8	2211	Sawyer	145	12	4600
"	86	9	4050	Sawyer	118	12	4900
				"	155	12	5000
"	104	9F	3500	Common	77	12	5050
				Sawyer	130	12	5069
"	100	11	3800	Common	107	12	5120
"	86	11	4326	Sawyer	115	12	5230
				"	129	12	5290
Sawyer	340	12	3055	"	105	12	5320
Common	150	12	3200				
				"	96	12	5605
"	136	12	3476	"	95	12	5770
Sawyer	180	12	3753	"	133	12	6050
Common	117	12	3893	"	80	12	6320
				"	78	12	6350
Sawyer	213	12	4027				
"	156	12	4180	Common	325	13	2000
Common	103	12	4255	Sawyer	493	13	2000
Sawyer	158	12	4386				

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.
Common	195	13	3000
Sawyer	297	13	3000
Common	132	13	4000
Sawyer	233	13	4000
"	333	13F	2950
"	232	13F	4027
Common	95	13	5000
Sawyer	150	13	5000
Common	74	13	6000
Sawyer	124	13	6000
"	92	13	7000
Common	147	14	3544
Pearl	107	14	5285
Common	167	14F	3090
"	103	14F	3400
"	108	14F	3800
"	112	14F	4050
"	67	14F	5672
Pearl	110	15	5488
Common	66	15	5802
Sawyer	150	15	5820
Common	97	16	4325
"	83	17	5067
New Rabbeth	132	19	6609
" "	110	19	7039
" "	99	19	7976
" "	66	19	9081
" "	103	19	9131
" "	62	19	9947
Pearl	134	20	5719
Common	83	22	5067
"	84	23	5609
"	108	25	4972
"	107	28	4895
"	110	28	5100
"	79	28	5240
"	161	28	5408
Mod. Sawyer	155	28	5413
Common	103	28	5460
Pearl	138	28	5488
"	120	28	5735
Common	143	28	5842
Mod. Sawyer	138	28	5851
Sawyer	122	28	6002
Common	78	28	6059
Pearl	107	28	6059
Sawyer	116	28	6059
"	121	28	6059
Old Rabbeth	141	28	6059
Pearl	141	28	6059
Common	122	28	6386
Mod. Sawyer	117	28	6418
Common	106	28	6929
Mod. Sawyer	105	28	6954
Common	92	28	7539
Mod. Sawyer	91	28	7573
" "	81	28	8113
Common	82	28	8124
Mod. Sawyer	71	28	8934
Common	71	28	8948
New Rabbeth	82	28	9100
Old Rabbeth	178	29	5104
Common	88	29	5200
"	102	29	5464

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.
Commn	345	30	2000
Sawyer	539	30	2000
Common	210	30	3000
Sawyer	323	30	3000
Common	145	30	4000
Sawyer	199	30	4000
Common	108	30	5000
Sawyer	169	30	5000
Common	91	30	5010
"	78	30	5890
"	80	30	5950
Heavy Common	66	30	6000
Common	83	30	6000
"	84	30	6000
Light Common	90	30	6000
Sawyer	132	30	6000
Old Rabbeth	134	30	6000
" "	116	30	6100
Common	70	30	6356
Sawyer	106	30	7000
"	85	30	8000
McMullan	86	30	9100
"	96	30	9100
Common	95	31	5380
"	87	31	5540
"	77	31	6020
Sawyer	125	32	6488
Common	101	33	5900
"	107	34	5154
"	94	34	5727
"	89	34	6187
Sawyer	114	34	6591
Common	97	34F	5066
Eureka	92	35	9593
"	76	35	9729
"	80	35	9851
"	91	35	9940
"	85	35	9955
Common	90	37F	5240
Sawyer	147	40	5857
Sawyer old bol.	152	40	6000
Sawyer new bol.	195	40	6000
Sawyer	143	40	6260
Whitin	130	40	8589
"	112	40	9491
Common	92	41	5950
Common	92	42	5959
Sawyer	169	42	7003
Common	148	46	5857
"	90	48	4930

FIGURES ON POWER.

Published by Geo. Draper & Sons in 1876.

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	
Common	98	25	5460	Actual tests.
Sawyer	152	25	6627	" "
Common	100	50	5893	" "
Sawyer	176	42	7003	" "
Pearl	69	12	5300	" "
"	68	12	5470	" "
"	81	12	5780	" "
Sawyer	96	12	6070	" "
"	93	12	5980	" "
"	143	40	6260	" "

GEO. DRAPER & SONS' STATEMENT IN 1881.

Kind of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	
Sawyer	150	30	6000	Estimated from tests.
"	138	30	6500	" " "
"	125	30	7000	" " "
"	110	30	7500	" " "
"	95	30	8000	" " "
Common	95	30	6000	" " "
Sawyer	102	30	7800	" " "
New Rabbeth	85	30	8500	" " "

TESTS

Taken at Dwight Mfg. Co., April, 1885.

(From Emerson Scale Co. Catalogue.)

GEO. DRAPER & SONS' STATEMENT IN 1887.

Name of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	Name of Spindle.	Spindles to H. P.	No. of Yarn. Speed.	
Whitin	99	14F	5182	New Rabbeth	150	30	6000 Estimated.
Common	83	21	6409	" "	138	30	6500 "
New Rabbeth	140	28	6763	" "	120	30	7000 "
Sawyer	135	28	7038	" "	110	30	7500 "
New Rabbeth	120	28	7439	" "	95	30	8000 "
				" "	70	30	9000 "

COMPARISON OF SELECTED TESTS ON DIFFERENT SPINDLES

Eliminating those that do no seem to scale properly.

Name of Spindle.	Spindles to H. P.	No. of Yarn.	Speed.	Page.	Rec. No.	Date of Meeting.
Common	108	30	5000	52	10	Apr. 19, 1871
Sawyer	169	30	5000	52	10	" " "
Old Rabbeth	178	29	5104	18	14	" 16, 1873
Common	103	28	5460	24-5	16	Apr. 15, 1874
Pearl	138	28	5488	32-3	16	" " "
Common	101	33	5900	24 5	16	" " "
Sawyer	132	30	6000	52	10	Apr 19, 1871
Old Rabbeth	141	28	6059	40	15	Oct. 15, 1873
Pearl	141	28	6059	30-31	16	Apr. 15, 1874
New Rabbeth	150	30	6000	G. D. S.	Esti.	1887
Modified Sawyer	117	28	6418	50	38	Apr. 29, 1885
New Rabbeth	140	28	6713	Dwight	tests	" "
Sawyer	106	30	7000	52	10	" 19, 1871
New Rabbeth	120	30	7000	G. D. S.	Esti.	1887
Modified Sawyer	91	28	7573	52	10	Apr. 19, 1871
Common	92	28	7539	52	10	" " "
New Rabbeth	120	28	7439	Dwight	tests	" 1885
Modified Sawyer	81	28	8113	50	38	Apr. 29, 1885
Common	82	28	8124	51	38	" " "
New Rabbeth	95	30	8000	G. D. S.	Esti.	1887
Modified Sawyer	71	28	8934	50	38	Apr. 29, 1885
Common	71	28	8948	51	38	" " "
New Rabbeth	82	28	9100	20	55	Oct. 26, 1892
McMullan	86	30	9100	61	52	Apr. 27, 1892
Eureka	92	35	9500	60	38	Apr. 29, 1885
Whitin	112	40	9491	21	44	Apr. 25, 1888

A careful investigation of these records will show that they are practically valueless for purposes of comparison. The same spindles do not test uniformly even when at the same speeds and on the same numbers of yarn. It is impossible to establish any rule for increase of speed by them or any rule for increase by variation in yarn produced. The different types shown do not vary on the same scale with change of speed, the Sawyer spindle, for instance, increasing power in a much higher proportion than others. This is probably due to the fact that the Sawyer spindle was not designed with a sufficiently stiff shaft. This fact proved of benefit to the trade, as it led to the development and introduction of the modern high speed spindle. The records of the common spindle show that it could apparently run at quite a high speed. These tests, however, were simply made for power comparison, as it was impractical to run this type in mill use beyond a certain limit. The modern types of spindle are shown to take considerably less power at the same speed than any of the former types. This is due partly to improvement in design and partly also to education in the matter of band tension and use of better oil.

PRACTICAL METHODS OF POWER TESTING.

Power tests are necessary for various purposes. In the first place it is often necessary to find out how much power is required for a spinning-room without regard to the spindle itself. It is sometimes possible to determine this factor by indicating the engine when running the spinning department alone, or by attaching a power scale to the main driving shaft of the room. It is, of course, impossible to get an accurate result by merely testing one frame, as the frames themselves vary considerably, owing to variation in tension of their driving belts, and the friction in many of their bearings. Another reason for power testing is to determine whether power can be saved by making certain changes in the spindles or the methods of using them. There is great practical advantage in such tests, as we have always found when testing frames that it was possible to save a con-

siderable fraction of power by simply putting the frame in what we consider proper condition for testing.

The simple methods of reaching these conditions could be easily enforced in any spinning room at slight expense, with great saving. Very few mills pay sufficient attention to their bands. Very few use a proper oil. Many never take advantage of the adjusting fit which may be present in their spindles, thereby allowing them to correct bad running and loosen tight bearings. As before stated, hardly any mill pays any attention to the removal of dirt from the spindle bearings. Then there are the evils of too heavy roll weighting, frames out of level, rings out of center, accumulation of dirt, etc.

A third reason for testing is to determine what sort of spindle to use, and how much improvement in design is possible. These tests are usually left for the spindle manufacturer, although certain mills have made them for their own conviction. The Sawyer Spindle Company has naturally undertaken the greatest amount of investigation in this particular line and the experience from which I write this article has been acquired while in charge of such experiments. During the last ten years I have tested power for them in nine separate places involving about a year and a half of time.

Apart from the regular trade spindles on which the majority of the tests have been made, there were included over 40 distinct experimental types involving the manufacture of about 8,000 spindles which were never used after the few days testing. Experiments on spindles in other directions not involving power tests, have, of course, required the manufacture of tens of thousands, as we often put in several thousand of an experimental type when testing the wearing or working qualities of new ideas.

In the various power tests alone there have been several hundred separate series of records, each split into various divisions, and each repeated several times to insure accurate averages. The problems involved present such divergencies that each test in turn teaches some new truth or disproves some old theory. Our tests have not been varied enough to include many different

spinning conditions, as it is evidently better for purposes of comparison to keep the conditions practically uniform.

In the usual loose talk about power matters one spindle is referred to as having made a record of a certain per cent. less power than another, simply for the reason that the spindle figured less spindles to the horse power. Such a method introduces many possible errors, as the same frame under different conditions can vary even 100 per cent. in power without undergoing any modification in the spindle itself. The reason for this variation is that the average power of a frame spinning per spindle is a mere addition of power units taken by different parts of the frame, some of which have nothing to do with the spindle. Unless the conditions can always be kept uniform, comparison of spindles themselves is more or less indefinite. The simplest way to arrive at such comparison, therefore, is to eliminate so far as possible all the elements which must be similar, whatever the spindle structure.

It will not do, however, to test the spindles simply running bare, as the application of a load affects different models with a curious variation in result. For instance, it has frequently happened that certain models consume less power bare, and more power loaded, in comparison with another type. All things considered, it is preferable to compare spindles by running them with their full load of yarn with the rolls and traverse motion of the frame out of gear. This method eliminates the yarn drag, but is found to fairly show the peculiarities in various types. The only proper method by which to illustrate a frame test is to give the actual horse power consumption by each element of the total power. This is perfectly easy to accomplish, and if pains are not taken to so sub-divide, results are necessarily less valuable.

The question of spindle power involves another spindle characteristic which must not be lost sight of.

Given a certain power result, from a known spindle tested under proper conditions, it would be perfectly simple for any power expert to test another spindle really inferior, or the same one, and

produce more favorable figures by sacrificing good running, or designedly making the conditions unequal. In comparing two spindles equality in running is highly important. A spindle running with a loose bearing fit, a loose band or a low speed, does not usually run so steadily as with the opposite conditions, although when performing work the eye may not be able to detect the motion. It has been well argued that this slight tremor was of no disadvantage to the yarn, and of much advantage to the spindle, as it was an indication of economy in power and wear. This form of vibration is entirely different from the harsh jar arising from a crooked or imperfect shaft, or a spindle construction which does not allow sufficient yield in the bearings. The fact that a spindle runs well bare by no means proves its worth. Many a design that runs smoothly without a load is absolutely worthless when spinning yarns at high speed. On the other hand many a spindle which has a slight wabble running bare will steady itself under the application of a bobbin. Spindles are not made to run naked, as they are near enough the human stage to require a textile covering.

The fact that the ordinary spindle is designed for use on yarns from No. 20 upwards, and use with rings varying 1¼ to 2 inches, also different lengths of traverse, renders it inevitable that no single condition is perfectly met.

The requirements for a very fine yarn spun on a small bobbin with a small ring are entirely different from those of a coarse yarn on a heavy bobbin.

A spindle could be designed for the fine yarn that would undoubtedly take a little less power and perhaps run with greater steadiness under a light band tension and loose bearing fit. The gain, however, would not be sufficient to counterbalance the disadvantage of having a spindle that could not be used for heavier work when necessary.

The modern spindle meets nearly every requirement. It can run at any speed desired with the necessary steadiness; it has at present many conveniences, will wear for years, does not get easily damaged, and has apparently little chance for improve-

ment so far as consuming power is concerned. Future improvements, therefore, must relate either to some method of reducing the band tension or possibly reducing the expense of manufacture. Of course the future may develop a spinning machine in which a spindle, as we know it, will be eliminated or replaced by a structure having entirely new mechanical features.

The following plan of making a power test is suggested from the experience of the writer as having been used on recent important experiments with highly satisfactory results.

If a test is made on a frame in a mill, first find the power consumed as it stands, by the following method:

It is understood, of course, that the person making the test shall thoroughly understand the use of dynamometer or power scale. Unless this knowledge has been acquired, the test will have no value.

First, take the power consumed by the frame spinning just before doffing. Then take the power directly after doffing. Take all readings at the centre of the traverse. This gives the two extremes of spinning and by adding together and dividing by two the average power of the frame will be given as accurately as possible without involving a large amount of figuring. It is more satisfactory than taking the power when the spinning first starts, and then waiting for the bobbins to fill before determining the average power taken, as the necessary length of time may introduce great changes in atmosphere, thereby vitiating the test. After the empty bobbins have had about fifteen minutes' delivery of yarn on them, break the ends all down, keeping the rolls running, and carefully determine the power. Then throw the rolls out of gear and run the spindles with the small bobbins on them. The difference between these two power records will show the actual power consumed by the rolls and traverse motion.

Then take these small bobbins off, replacing with the full bobbins, running the spindles without the rolls as before. By adding this record together with the record of the small bobbins without rolls and dividing by two, the power taken by the

average weight of the yarn load and spindle is known. Then take the bobbins off and run the spindles bare. Subtracting this record from the former one will show the actual power taken by the average yarn load with its bobbin. After having repeated this series several times to get the proper average, weigh the band pull carefully and then cut the bands entirely off.

Now the actual power of the cylinder can be taken. With these records the power is sufficiently divided for practical purposes. By adding the power of the spindle, the weight and the rolls together, and subtracting from the power taken by the average of spinning, the result will give the average power taken by the traveler pull.

Having these records it is possible to find out how much power can be saved by getting the frame in better condition. First, see that it is accurately levelled and then carefully clean and oil every running part. Then go over the spindles and make sure they are properly set to the rings at all parts of the traverse. Go over the guide wires and see that they are all centered, removing any wires that are badly worn.

Then take the spindles apart and clean the bearings thoroughly in naphtha or with a steam jet, removing the old oil from the base with a suction pump and swab. Then, if the spindles have adjustable bearings, see that the fit is made uniform. Then apply new bands, running them long enough to take out the first stretch. Next carefully weigh the band pull and by cutting tight and loose bands get the average down to as near two pounds as possible. When this tension is reached properly it must be maintained as constantly as possible, even if the band pull has to be taken as often as twice a day, as otherwise the comparisons in the tests will be largely a comparison of bands. In figuring the test results make proper allowance for any fraction of tension above or below the standard.

Now run the spindles bare until it is evident that they have reached a uniform consumption of power. From this on tests can be made without waiting for the intermediate filling of bobbins by simply putting the large bobbins on, piecing up,

running about fifteen minutes, and then doffing. By counting the number of layers of yarn applied meanwhile, it is easy before the next test to wind off this amount, thereby having the conditions uniform for all tests. Of course if the bobbins get snarled or damaged spin fresh ones.

If it is found during testing that certain elements which should be constant, vary excessively, continue the records until the error is eliminated.

Tests should be made at a uniform time of day, if it is possible, as the bands may contract over night, affecting the power consumed in the first few hours.

On rainy or damp days, if tests are taken, it will be necessary to make allowance for the change in band pull and other conditions, as the power will necessarily be greater. Moisture affects bands in other ways than the mere contraction. A band may have small tension and yet consume power by not being pliable. If making comparative tests, it is safer not to run on such days. The general stickiness affects the general conditions in many annoying ways.

If the tests include comparison on different spindles, it is essential either to have them taken from new lots that have not run or to have two lots that have had equal wear. If comparing adjustable taper bearing spindles with the straight bearing spindle, the looseness of fit in the taper bearing must be made as uniform as possible with the looseness allowed the other.

DIVISION OF POWER AS RECORDED IN SEVERAL KNOWN TESTS

SHOWING HOW RECORDS SHOULD BE SUB-DIVIDED FOR PROPER COMPARISON.

Date of test	Jan. 1874	Mar. 1878	Sept. 1878	Jan. 1889	Sept. 1891	Mar. 1892
Made by	S. Webber	J. B. Francis	W. S. Southworth	G. O. Draper	G. O. Draper	G. O. Draper
Place	Baltimore	Nashua	Lowell	Manchester	Grosvenor Dale	Manchester
Frame	204 spindles	208 spindles	160 spindles	192 spindles	176 spindles	240 spindles
Spindle	Common	Sawyer	Pearl	McMullan	49D Rab.	49D Rab.
Speed	5050	5200	6420	8650	9300	9300
Roll speed	80	108	85	98	96	117
Yarn	12	12	28	30	43	28
Ring	1¾	1¾	1½	1⅝	1½	1¾
Traverse	?	6	5⅝	5½	5⅜	6
Band pull	?	?	?	2	1.8	2
Oil	?	?	?	36 g.	33 g.	33 g.

HORSE POWER REQUIRED FOR EACH SPINDLE.

Cylinder	.00787	.00112	.00053	.00511	.00609	.00640
Bare spindles		.00416	.00400			
Weight av. load	.00113	.00061	.00125	.00153	.00107	.00195
Av. traveler pull	.00191	.00289	.00194	.00163	.00183	.00341
Rolls and traverse	.00111	.00066	.00071	.00100	.00100	.00090
Total H. P. of av. spindle	.01202	.00944	.00843	.00927	.00999	.01266
No. spindles to H. P. av. spin.	83.	106.	118.	107.	100.	79.

POWER CONSUMPTION UNDER VARIOUS CONDITIONS.

The ratio of power consumption to band tension is found to be uniform enough so that a scale may be figured sufficiently accurate for ordinary practice on the usual spindles. Where larger size spindles, such as are used for coarse yarn or twisting, are used, a different scale would be necessary.

An important factor in band power is the size of the band. A large band produces more air resistance, and consumes more power at the same tension. The scale given, therefore, is figured for two sizes of ordinary bands. It might be said, however, that the large bands have little excuse for use on the usual spindle.

Revolutions.	Bands about 120 to the pound H.P. per spindle.	Bands about 80 to the pound H.P. per spindle.
At 1000 each pound of band tension adds	.00017	.00027
" 2000 " " " " " "	.00035	.00050
" 3000 " " " " " "	.00055	.00065
" 4000 " " " " " "	.00075	.00090
" 5000 " " " " " "	.00095	.00115
" 6000 " " " " " "	.00120	.00140
" 7000 " " " " " "	.00145	.00170
" 8000 " " " " " "	.00170	.00200
" 9000 " " " " " "	.00200	.00230
" 10000 " " " " " "	.00230	.00265
" 11000 " " " " " "	.00260	.00300
" 12000 " " " " " "	.00295	.00340

These figures are derived from actual tests supplemented by figuring for speeds not actually tried. The pressure of the band itself increases the power at a practically uniform ratio, but the air resistance increases at an ascending ratio. The figures given have nothing to do with the power taken by the spindle independent of its band tension. For instance, suppose a frame with a known band tension of three pounds shows 80 spindles to the horse power, on average spinning conditions, at 8,000 revolutions, small bands being used, to figure the power with a two-pound tension, divide one by 80, giving the number .0125, which represents the actual horse power taken by each spindle; then subtract .0017, the power added by a pound tension on

one spindle at this speed; the remainder will be .0108; this divided into one gives 92 and a fraction, which is the number of spindles to the horse power which would be obtained at a pound lower tension.

It is also evident that these figures will show the power which would be consumed by the spindle, supposing some method of driving were invented which would eliminate the entire tension. For instance, taking the first figure of 80 spindles to the horse power at a three-pound tension, figuring .0125 horse power for each spindle, the horse power added by the three-pound tension is three times .0017, or .0051; subtracting this from .0125 leaves .0074 horse power per spindle, or, dividing into one, equals 135 (and a fraction) spindles to the horse power. Looking at it in another way, the band tension of three pounds in this instance consumes $\frac{51}{126}$ of the total power required by the whole frame.

POWER CONSUMPTION OF VARIOUS ELEMENTS.

Absolute division of power units under certain definite condition. Some of the figuring involves estimates within certain known limits.

Speed, 8,500; band tension, 2 lbs.; bands weigh 120 to lb.; bobbin weight, 500 grains; average weight of yarn weighs 800 grains; No. of yarn, 26–28; 7 inch traverse; 1¾ ring.

		Indicated H. P. per Spindle	
1.	Lateral friction and air resistance of frame cylinders,	.00032	
2.	Air resistance of bands,	.00100	
3.	Friction of bare spindles due to band tension of 2 lbs.,	.00270	
4.	" " " " " centrifugal force of uneven mass and air resistance,	.00264	
A.	Total power of cylinder bands, and bare spindles,		.00666
5.	Vertical friction due to weight of spindle and average load,	.00000*	

*The increase of weight within the usual limits does not effect the power taken by certain modern spindles. This is proved by a test with iron cylinders absolutely true and smooth so far as possible. The increased power taken by the bobbin of yarn is due to its rough surface and eccentricity of weight. Theoretically any weight must increase the vertical friction, but in practice the weight probably aids in steadying the spindle and thus cancels its expected requirement.

		Indicated H. P. per Spindle.	
6.	Friction from centrifugal force of uneven mass in bobbin,	.00030	
7.	" " " " " " " " average yarn load,	.00090	
8.	Air resistence of yarn surface on average load,	.00080	
B.	Total power of average yarn load,		.00200
9.	Pull of traveler from friction and air resistence,	.00273	
C.	Total power of average traveler pull,		.00273
10.	Friction of rolls, traverse motion and gearing,	.00100	
D.	Total power of rolls, traverse and gears,		.00100
	Average total power of spindle spinning,	.01239	.01239

Number of spindles per horse power, **80.+**

.01239) 10000 | 80.+
9912
880

The results noted in lines A, B, C and D are sufficient for ordinary practice.

Taking the result of this test at 80 spindles to the H. P. or .01239 H. P. per spindle, consider what the evil effect of certain common faults might add. The following figures are not estimates but were actually derived from tests in mills.

*Good running condition	= .01239	H. P. per spindle.
A cramped cylinder has often added an extra	.00030	" " " "
An increase of band pull to three pounds will add	.00185	" " " "
Cheap low gravity oil will certainly add	.00200	" " " "
Dirt and sediment in the spindles have shown an extra	.00300	" " " "
Poor bobbins could easily add	.00030	" " " "
Too heavy travelers or rings out of centre might add	.00050	" " " "
Rolls poorly oiled, tightly fitted or too heavily weighted have added	.00200	" " " "

.02234) 1.0000 | 44+ spindles to HP.
8936
1064

* Equals 80 spindles to horse power in this case.

The reduction from a possible 80 which is by no means a maximum to 44 seems unreasonable, yet we have known of a showing of 50 spindles with conditions similar so far as speed and yarn are concerned to the first test quoted. This compari-

son assumes the same type of spindle in both cases. If an inferior style is used there is yet more chance for waste of power.

The question of the ratio of power to speed is not so simple a problem as that of the ratio of band tension. It has always been assumed that a spindle increased its power in accordance to the speed by a certain definite formula, the plotted curves being always constant; that is, if the power increased at a certain proportion from 5,000 to 6,000, the same formula used would show usually a larger increase from 10,000 to 11,000. As some of the elements of power are supposed to increase at a uniform ratio, and others at a constantly increasing ratio, the addition of both would produce a rate of increase somewhat higher than a uniform scale.

Actual tests, however, do not bear out such a theory, as a curve plotted from actual experience begins to flatten at a certain speed, which probably varies with the class of spindle tested.

On a certain type I have experimented with the turn of the curve takes place at about 8,500 revolutions. From then on the curve shows a diminishing rate of power to speed, proving that a higher economy of power is reached by running the spindle at speeds above this figure. The reason for this apparent anomaly I think may be explained in several ways. In the first place, the increase of power at high speed comes largely from a friction due to pressure of the spindle on its bearing. It is well known that friction in a bearing with oil as a lubricant does not increase in proportion to the pressure at a constant ratio.

It is also known that the oil when warm gives better results for friction than when cool, and it is evident that at a high speed the spindle will produce a higher temperature in the oil.

Another element of great importance is the fact that the modern type of spindle runs better at 10,000 turns than at 8,000 turns; that is, it has less tendency to wabble. This fact must have a great effect on the power question, and could by itself explain the reason for the results noted.

On account of these peculiar actions it is impossible to give a scale of variation which can be considered uniform for all types of spindle. It is therefore requisite to actually make tests, if this question needs to be determined. The following table gives results from a quite modern construction of spindle.

RATIO OF POWER TO SPEED.

Figured for a modern spindle from actual test under following conditions: Band tension 2 lbs. on average: bands weighing 120 to lb.; bobbin weighs 500 grains; average weight of yarn load weighs 800 grains; No. of yarn spun 26-28; 7-inch. traverse 1¾ ring.

		IND. H. P. PER SPINDLE.				
TOTAL POWER	Revs. 7000	8000	9000	10000	11000
Of cylinder and bare spindles,	.0047	.0060	.0070	.0078	.0085
" average yarn load, with bobbin,	.0009	.0016	.0021	.00255	.0029
" average traveler pull,	.0010	.0021	.0029	.00325	.0035
" rolls, gears and traverse motion,	.00065	.0009	.0011	.00125	.0013
" frame under average spinning conditions,	.00725	.0106	.0131	.01485	.0162
No. of spindles per horse power =	137+	94+	76+	67+	61+

It must be distinctly understood that this scale of variation is not necessarily adaptable to any other spindle or any different conditions. Of course it may aid in estimating.

Any mill interested in economy of power should give attention to the following points many of which have already been noted:

The spinning frame itself should be driven through a long belt if possible, which can have less tension, and where short belts are necessary, the frame pulley should be large for the same purpose. The belt tension is not included in the usual frame power test, but its variation is often equivalent to over 20 per cent. of the power taken by the frame itself.

The use of large rings and long traverse must affect the question of power, although there is usually more than enough economy in other directions to balance the extra power required.

The speed, of course, governs everything, as velocity increases power at a ratio which is usually higher than a mere percentage. We have known of several instances, however, where mill men considered our spindles defective on noting the increased power required by new frames, losing sight of the fact that they were both increasing the speed and the size of the bobbin. Coarse yarn will inevitably take more power to produce than fine numbers. Heavy spindles of the same style will always take more power than light ones, although the power comes rather from the increase of bearing section and centrifugal force, than the mere added weight.

By using a little care the regular small spindle can be used for quite heavy work with a great saving in power, especially as the heavier type naturally requires a higher band tension also.

Few mills have yet appreciated the folly of using cheap, low-gravity spindle oil. A cent held near the eye will hide a dollar not so near at hand. The oil drummers have worn this trick threadbare for certain peculiar motives of their own.

Enough has already been said about band tension, cleanliness and proper oversight. It would, no doubt, pay any large mill to employ a spindle inspector who should personally be responsible for the proper running condition of every spindle, ring, guide-eye and roll in each frame. Mr. THOMAS of the Tremont and Suffolk Mills, referred to the benefits of such a system, at the last meeting.

Finally, remember that all unusual power test quotations should be considered with due regard for the motive back of the claim and the experience of the expert employed. Weighing power is a far more complicated problem than weighing coal or groceries, with even greater chances for deception either intentional or otherwise. The usual mill has men competent to make a comparative test that will show them how to improve their running conditions. The results will probably be valuable for use even if inaccurate in detail. The average man can discover which of two horses is the faster even if his estimate of the exact rate of speed in either is badly at fault.

Technical detail in a limited line is necessarily dry and uninteresting. The foregoing is rather for purposes of reference when necessary than for general interest.

The PRESIDENT. Gentlemen, in the discussion of this paper by Mr. DRAPER, or any of the papers that will follow this, I wish to say two things well known to you all; first, perfect freedom, and in this I wish all the Philadelphia gentlemen here and and all the gentlemen from the South at these meetings, will feel the same freedom that we do, freedom to speak or not, just as you please; the only restriction we make is that, in justice to other people, confine any remarks to two or three minutes, in the discussion of this paper and also of our topical questions. If you have not more than a sentence to say, if you don't wish to say it, don't say it; but at any rate, not over two or three minutes.

I would like to hear, if I could, from any gentlemen here who have made tests of any of the power frames by using the motor. I suppose there are some gentlemen in the room who may have tested the spinning frame by the use of the electric motor, and I think those results would be extremely interesting. Anybody who doubts the effect of damp weather on power, or the amount of power it takes in running — to start up — can have it explained to them very thoroughly if they will put some spinning frames on a small electric motor and watch the changes.

Mr. EDWARD ATKINSON. I understand that the point of Mr. DRAPER'S paper is to save fuel. I observe that he has omitted one of the most important elements in that problem. There are two ways of saving coal: one is by perfecting the spinning frame, the other is at the boiler-house. Mr. DRAPER has left out the man who shovels the coal. In our recent investigations in the manufacture of steam we found that the difference in the cost of moving the coal from the last dump to the boiler furnace, in the contrast of the worst system as compared to the best, amounted to over one hundred and twenty thousand dollars ($120,000) a year on less than twenty-five hundred (2,500) boilers. The excess of cost in this one item, shovelling coal, above a fair average cost, was over fifty thousand dollars ($50,000). At a cost of eighteen dollars ($18) subscription on six boilers to the Steam Users' Association one establishment is now saving nearly a thousand dollors a year. The Steam Users' Association has finished its work, but it is my purpose as president of the Mutual Boiler Insurance Company to continue these investigations on the same line and to make the Mutual Boiler Insurance as useful to its members on other matters than the mere contract of indemnity as the mutual fire insurance companies have been.

Mr. LOUIS SIMPSON. I think that no one can criticize Mr. DRAPER'S paper unless they take it home and study it. But there is one point touched upon in that paper, the question of spindle banding. I understand — I think it is correct — that Mr. DRAPER thinks that their spindle now is as near perfection as possible; but spindle banding is just as it was twenty years ago. It strikes me this morning, what would the result be if we would make our spindle banding of mercerized yarn, — we mill men are not chemists; those of us who may have had little to do with chemistry are too busy to go into this question, — but from what little I know of mercerized yarn, I think mercerized yarn might prove of advantage, and I would suggest that this

Association give a prize so that it would induce some chemist to make experiments as to the benefits to be found out in that line.

Mr. D. D. DONOVAN. On page 179 of Mr. DRAPER'S paper, some attention was given to the lubricant to be used to preserve free-running spindles.

It might be of use to the members if I should state some experience of the Brown & Sharp Mfg. Co. with lubricating oil.

We have used an oil known as *No. 2 Cosmoline Oil* in our main line bearings for twenty years or more with excellent results, and we have finally settled down to the No. 2 Cosmoline for lubricating purposes.

I call attention of the members to this matter at this time because, on occasion of a visit to the Bourse Building this morning, I met the representative of the firm of E. F. Houghton & Company, Philadelphia, from whom we procure this oil, and would say that he has samples in their exhibit that the members may examine on their visit to the Bourse, and can also obtain information regarding it.

We use what is known as *No. 1 Cosmoline Oil* for coating machinery to prevent rust, but the No. 2 is our standard lubricant. Our main line bearings are provided with a feeder which conveys the oil from the oil well to the shaft, and it only requires to be supplied with oil once a year.

The PRESIDENT. Topical Question No. 85 on your program on the subject of spinning rings: Does anyone know how to make them and how large is it advisable to have them on the different numbers of yarn to be spun? I will call upon Mr. JOHN T. MEATS to open the discussion.

Mr. JOHN T. MEATS. I will say before I give this paper, that in writing to one of our representatives down South I put it on a rather more conservative line than this. I speak just simply of the things I know; not of what ought to be done, but which can be done, have been done and ought to be done again.

This contribution to the discussion of Topical Question No. 85, is given by invitation of the Secretary of the Association; but, inasmuch as a lucid and comprehensive paper on the manufacture of spinning rings, was read at the meeting of this Association held in Boston last April, it may be assumed that the first part of the question was suggested by the well-known plentitude of imperfect rings, as tested by modern requirements; and it might be answered briefly by affirming that there are men who know how to make rings, but that the uncertainties attending the processes are so many and great, that the production of practically perfect rings is not always attained. Also that in meeting increased competition, and consequently low prices, the ring makers do not, or cannot without loss, produce the very best article possible.

It is unfortunate if the makers of rings cannot get enough for their product to warrant the best possible effort, regardless of expense; and, if a slight digression may be permitted, it might be said that this would apply also to makers of certain textile machinery. It is, however, doubtful economy to place reduction of cost of production before quality, in the article produced, with the inevitable result that before the machine, or part of a machine has been in use one-tenth of a life-time, the maker, to save or patch up his reputation and to propitiate the purchaser, frequently sends his mechanics to the mill to do work which ought never to have been necessary; and which, besides being a source of expense to himself, is a hindrance and source of loss to the mill. If this extra expense had been incurred in the first place, in carefully designing and testing his product before placing it upon the market, it would have been better for all concerned. As an excuse for this digression, it may be said that the manner in which the first part of this question is put,

conveys the impression that someone has suffered from imperfect work; and, if the expression of a personal opinion may be permitted, on the part of one who is somewhat insistent in pursuing the axiom that the product should first be made as perfect as conditions will permit, I would suggest that, if such an axiom be intelligently pursued, the cost of the product need not necessarily be enhanced. I said "intelligently pursued", because so much has been done of late by machine tool makers, in producing tools to reduce the labor cost of the heavier kinds of machinery, and the saving effected has been so self-evident, without deterioration in the quality of the article produced, that many makers of lighter products have been led to adopt the same tools, with the result that the parts acted upon, being too light to withstand the great pressure necessary to perform the work quickly, become distorted beyond recovery.

This may be the trouble with many spinning rings, as well as some machinery placed upon the market; and, as a result of extreme effort to sell, regardless of the interests of the purchaser, is much to be deplored. The spinning ring, however, performs such a vital function, and so much is expected of it in these days of high speed, that the production of a satisfactory article is attended with extreme difficulty in the selection of the material of which it is to be made, as well as in the forming and finishing processes. Considering, therefore, the many difficulties which are to be contended against in the manufacture of a perfectly concentric, smooth and uniformly hard ring, this part of the question might be answered by stating that, while some men undoubtedly know how to make rings, it frequently happens that they do not produce the best article possible, and for the reasons already stated.

The second part of this topical question, as to how large it is advisable to have rings on the different numbers of yarn to be spun, is a subject somewhat apart from the first part of the question; and, in order to answer this part of the question specifically, it would be necessary to assume certain conditions; such, for instance, as the quality and length of staple used, and

the processes of preparation through which it is to be passed, before coming to the spinning frame. For, while it is a fact that No. 80 yarn, with 27¼ turns of twist per inch, has been spun with complete success with a 7-inch traverse and 2-inch ring, from combed Sea Island stock, it would be idle to assume that it could be done with ordinary stock. And even after assuming a certain grade of cotton as a basis, it would probably be impracticable to compile a table of ring diameters for various numbers of yarn, which would fit every case, because the variation in preparatory processes, due either to the hang-up and condition of the mill, the condition of the machinery, or the manner of running it, would render such a table useless, except as a guide in a general way. The length of traverse, too, has much to do with the possibilities bearing upon this part of the question.

Taking ordinary cotton, single carded, drawn three times and put through a slubber and two fly frames, the following table of ring sizes and corresponding yarn numbers, is submitted; but rather in the hope of eliciting information for the benefit of the Association, than in the belief of giving any which might be new to its members:

Nos. of Yarn.	Diameter of Ring.	Warp Twist.
5 to 15	2½-in. to 2⅛-in.	" "
15 " 25	2⅛ " " 1⅞ "	" "
25 " 35	1⅞ " " 1⅝ "	" "
35 " 45	1⅝ " " 1 7/16 "	" "
45 " 55	1 7/16 " " 1¼ "	" "

For filling twist, reduce the diameter from 15 to 25 per cent., according to twist in yarn.

In the spinning of yarn from cotton of higher grades, the use of much larger rings and longer traverse is of course possible, but in varying degrees; and if the actual example of producing 80s yarn, with 27.25 turns of twist, 7-inch traverse and 2-inch ring, has been surpassed in every-day work, it will at least be interesting to some of us to know it. A bobbin of this yarn

may be found on the Secretary's desk, for the inspection of members; and I shall be glad to answer any questions in my power, that may be asked concerning its production.

The PRESIDENT. Gentlemen, would you like to ask Mr. MEATS any questions?

Mr. JOHN ECCLES. I would like to ask if there are any separators on this frame?

Mr. JOHN T. MEATS. I intended to say that there were no separators on that frame. I had the frames built for separators so that in case they were caught and found themselves unable to spin that yarn, they might apply them; but my advice is to get along without separators in spinning yarn for thread work.

Mr. JOHN E. PREST. How fast do you run the front rolls?

Mr. JOHN T. MEATS. The speed of the front was 90 revolutions on the $1\frac{1}{16}$-inch roll, which, of course, allowing for an inch roll would bring it up to nearly the equivalent of 95 to 96 turns on a one-inch roll.

Mr. HENRY T. WHITIN. You said they run 27¼ turns of of twist. That is less than three times the area that would be practical for weaving yarn for thread yarn. It might be put into 6-ply.

Mr. JOHN T. MEATS. I doubt whether it would for weaving — it is considerably less than anything I know of for weaving yarn; but this preparation was, perhaps, as good as anything in the world, for, as you perhaps know, the thread mills of Newark have a perfect set of machinery; and in this case there seemed to be no difficulty whatever in spinning this number on a 2-inch ring, as Mr. WALMSLEY has stated.

The PRESIDENT. Well, Mr. MEATS is honest with it. Let us consider No. 86: "Is it practical to spin numbers finer than

65s on larger rings than 1½ with spindle running 9,000 revolutions"?

Mr. ARTHUR H. GULLIVER. Why did he select that diameter for the front roll?

Mr. JOHN T. MEATS. The diameters of the rolls were specified by Mr. WALMSLEY, superintendent, and also the style of weighting; all of which I strongly endorsed because in all the frames we have made for spinners of thread, that system of weighting has been adopted.

Mr. ARTHUR H. GULLIVER. I was not referring particularly to the system of weighting; I was referring to the diameter of the front roll; it would refer, then, to thread yarns rather than yarns for weaving.

Mr. JOHN T. MEATS. To be sure; for it is an advantage on any yarn to have a front roll that you absolutely are sure wont spring when weighted; but for short staples it is impracticable, because you cannot set the rolls close enough to draw properly.

Mr. ARTHUR H. GULLIVER. What length of staple would you consider to be long enough to require 1 1/16-inch front roll?

Mr. JOHN T. MEATS. With 1 1/16-inch front roll and 1-inch back, you would require an inch staple at least.

Mr. ARTHUR H. GULLIVER. That is, 1 1/16-inch and longer would be better on that diameter of roll?

Mr. JOHN T. MEATS. I think so.

The PRESIDENT. I assume that the length between bearings. He said in connection with the rolls that the gauge of this frame was three inches.

Mr. JOHN T. MEATS. Yes, sir; and there were six bosses to a roll, making the distance between the bearings 18 inches, centre to centre.

The PRESIDENT. It is well enough to remember that.

Mr. JOHN T. MEATS. I took every precaution in designing these frames to make them a success; and they were put into a room where the spinner had never run a ring frame in his life. He is an English spinner, an excellent one; and he ran this frame without help whatever from us.

Mr. GEORGE OTIS DRAPER. I hate to take the floor again so soon; but with reference to this question of spinning rings raised by Mr. MEATS, he seems to think that the manufacturers could give the public a great deal better ring if they would. Representing one of the manufacturers, I simply wish to say that if there is any way that we could better our ring, if anybody could tell us, we would be very glad to try it and adhere to it. The ring, as we make it now, we honestly make as well as we can; the stock we buy; we make our own ring blanks now; we pay at least three times as much as the men paid for the stock only — the men that made the blanks before we started making them. Those rings are turned in the same kind of machinery always used for that purpose; when it comes to polishing they are polished as much as they will stand; and when inspected are round, or else they could not pass the inspector. But you take a tempered steel ring and it changes; the strains that are put into that circle when it is made — the strains in every part of it—each one fighting against the other, and it is sometimes a question of time when one strain will get the better of the other and make that ring out of round. And of course, there are plenty of chances for improvement as new things are discovered in the manufacture; and if anybody can put us on to a new point in making these rings better, we would be glad to adopt it.

Mr. JOHN T. MEATS. I purposely made a digression in this paper to include the machinery builders as well as the ring makers. I don't wish to say that we make everything perfect — we try to. I reiterate that, as I acknowledge the difficulty. I say the spinning ring performs such a vital function, there is so much expected of it in these days, that there is extreme diffi-

culty in the selection of material of which it is composed, as well as in the formatory processes. I understand perfectly the difficulty of making a perfect ring, and I suppose the makers try to do the best they can; but it is difficult to get 25 per cent. absolutely perfect rings (because they cannot get steel that will harden uniformly, without distortion). The hardening process of steel of course is to be done afterwards and that is very rarely uniform. We find that with all kinds of hardened steel bearings, it is necessary, after they have been hardened, to grind them in order to make them perfect, although absolutely perfect before being hardened.

Mr. ROBERT MCARTHUR. I would like to ask Mr. DRAPER about the material of the rings; are they welded or drop-forge? I presume a great many rings are welded together, though I understand that drop-forging is much superior.

Mr. GEORGE OTIS DRAPER. In reply to that I will say that we drop-forge all our rings, and think that process superior or we would not use it.

Mr. JOHN ECCLES. I would like to ask Mr. DRAPER if, in making rings — by polishing rings — if it makes any difference with the wear of the ring by the polishing of them? It has been said that there have been various opinions with reference to a ring as to whether, when polished, it lost some of its wearing qualities. Is there anything in that?

Mr. GEORGE OTIS DRAPER. I will say in reply to Mr. ECCLES, I have had no experience that would lead me to give an opinion on that subject. Our rings we have been making in the last few years have perhaps twice as much, if not three times as much polishing, as the rings we used to make; and it will take several years to determine the wear. The rings that we made along in the 70's — there are many of them still running; and we have figured that the life of the rings we made in the first ten years for both flanges together is about 15 years; and

after ten or fifteen years' trial of the ring we have been making the last few years, I might answer the question.

The PRESIDENT. Now turn to Topical Question No. 89: "What is the best temperature and humidity for good spinning on fine counts"? I would be glad if Mr. ATKINSON will speak to us for a few moments on the matter in connection with No. 89.

Mr. EDWARD ATKINSON. Many years since, I had the honor to present to this Association the first microphotographs of the cotton fibre that had ever been taken in this country. I had myself never seen one before, but Dr. BOWMAN may have preceded in this work. I then read a paper on the treatment of cotton governed by the logic of its own form and structure. At a later date I caused the Garland atomizer to be brought to your attention.

From time to time I have presented the theory that nearly all future progress in the art of treating the cotton fibre, must be based on its own form and structure. I have called your attention to the fact that the cotton fibre is the only one that nature gives us that can be spun and woven without being freed from extraneous matter, like hemp or flax, or which must first be freed from its own grease, like wool, and then smeared with another grease in order to give cohesion to the fibres when under treatment. Silk comes nearer to cotton in being ready for use than any other fibre. I have given my attention to this matter from time to time. It has become more and more my confirmed conviction that the mechanical processes of ginning, baling, opening, picking, drawing, carding, and spinning, will one and all be subjected to very great changes and perhaps to complete revolution when we deal with the fibre of cotton governed by the logic of its form and structure.

The cylinder bale is the first step toward giving up crude and empirical processes and adopting scientific methods. The evils of our present processes are manifest in the fact that we destroy from 50 to 75 per cent. of the original strength and elasticity of the fibre on the way from the field through the saw gin, where the greatest injury is done, then through the compress and then through the factory. I commend to our southern members the importance of inventing the saw gin out of existence — it is unfit to be used.

We are also beginning at the other end. The cotton fibre is a most delicate hygrometer. It is now well understood that a constant of humidity at the right point is vital to success in spinning fine or even medium numbers, and is a factor even in the coarsest numbers. As we are working on a lessening margin of profit, the whole profit and loss account in many classes of goods depends on the climatic or atmospheric conditions. Even in coarse goods a variation has been observed of the cause of which the owners were unaware. The manager of duck factories in Maryland spinning all their yarns in the interior but weaving only a part at the spinning mill, the rest by the margin of the sea at Baltimore, observed more even and larger product per loom even on coarse duck.

The cotton manufacture of Great Britain is not only centered in Lancashire, but in special parts of that country where the humidity brought in from the Gulf Stream and precipitated on the crests of the high moors gives the most even constant. The fine spinning of this country has centered on the southeast coast of New England and in or near the valley of the Mohawk long before the study of climatic causes had disclosed the reason.

The importance of this matter is now so fully comprehended as to have led to the very wide use of the atomizer, the drosophore and other mechanical devices for keeping the atmosphere of the factory in a uniform and satisfactory condition. Let us hastily consider the reason for securing this uniformity.

Each convoluted fibre of cotton will take up its own twist and shorten in length in a dry atmosphere. It will relax and lose

in twist in a saturated atmosphere. The evils of the dry east winds of England are as well recognized in Lancashire as the saturated atmosphere of our "dog days" is in our own country. Our efforts are, therefore, to control both extremes. Nature does not provide an absolute constant, but the variations range from a change of 14 per cent. between morning and midday and between midday and night in the best positions, to 50 per cent. variation or even more in the unsuitable places. Our problem, therefore, is to improve upon nature.

The fault in all the mechanical devices is that unless they can be started sometime before the spinning or the looms, an hour or more will elapse before they bring the humidity of the atmosphere to the right point. This has been found to make a difference of nearly an inch in the width of standard No. 13 sheeting.

One process has been adopted in England which has not, I think, been practised here, namely, to carry an open shallow stream of water through the room, developing humidity according to the heat of the room, it being remembered that the capacity of the atmosphere to take up moisture increases very rapidly as the temperature is raised. I believe that a temperature of about 70° F. will take up 75 per cent. moisture if a sufficient evaporating surface is exposed to its action. That condition is the one in which plants thrive, which is conducive to health and in which spinning and weaving can be conducted evenly and surely. Of course the proportion of humidity must depend in great measure upon the area which is exposed to evaporation. In any event a flowing stream is subject to many objections. The water will gradually become warm unless the current is rapid, and then, I believe, the evaporation is less. Cannot a small amount of very cold water be exposed upon a very large evaporating surface at a higher temperature than 70,° then circulating of its own motion as the air is rendered cooler by the evaporation, throughout the area of the spinning or weaving room, thus at the same time promoting ventilation as well as humidity?

I long since tested this matter in a very crude way for the purpose of promoting ventilation in our old office, but having found a better method and my attention not having then been given closely to this matter of the cotton fibre, the subject was laid aside for more important work. Bearing in mind the tendency of hot air to rise and of cool air to fall, also bearing in mind that a large evaporation cools air very rapidly, I placed at a convenient point near the ceiling of our office where the heat is greatest, an open pipe in an upright position, of a suitable diameter. I lined the inside of this pipe with a very loose, fluffy, hairy, woolen fabric. Then near the top I placed a Garland atomizer throwing a spray over this hairy surface. I put a trough around the under edge to collect and carry away the excess of water which dripped into it. We measured the circulation with an anemometer and the humidity with a hygrometer. I do not recall the exact figures, but we proved that the heated air at the ceiling passed quickly and steadily through this tube where it was cooled, purified and moistened. It then circulated through the room. We also took the hot air of summer through a tube of considerable length, made of cotton on a bag loom. Moistening this we cooled the air on its way into the room by rapid evaporation.

I also devised an apparatus which seems to have been lately re-invented in Washington, for cooling the air of a room by exposing a copper chamber outside the house on the south side, open at the top outwardly and opening below at the top of a window inwardly, moistening the inside so that the hotter the sun the more rapid the evaporation, but fearing an excess of dampness I never put the idea into practice.

As I have stated, I had not then given the matter any attention with reference to the working of the cotton fibre. I now renew this theory — one of the many which I have presented to you, all of which, I believe, have in the end been justified — having confidence that some practical man may develop this idea. It is subject to no patent, and is now published in the common service.

In place of the tube lined with woolen cloth, a square box might be put up, into which what might be called curtains of lined flax could be carried, say five or six inches apart, kept moistened by capillary attraction from a trough of cold water alongside the tube. Evaporation would also take place from the surface of the trough.

Another method might be tested. Water could be brought to the tube or box through the axis of a fan in such a way that the fan would be worked by the stream of water, at the same time throwing a spray from its edges. If the quantity of water carried in the fanning tube to turn the fan were too great, the excess could be taken away through a pipe. This apparatus would be automatic. It could be kept in motion all night or from such time in the early morning as the watchman might start in order to prepare the atmosphere an hour or two before the starting of the machinery.

Some of these devices may have been patented. They are old with me, but if any of them have been made subject to patent claims there are many different ways of attaining the end, if the end can be reached in the manner described. I submit these suggestions in this informal way because I only thought the matter up a day or two since, and I have but one day to put the case in type before leaving for the meeting. It is submitted for amendments, correction or withdrawal if on reading the proof it may not stand criticism. Suggestions are called for.

SUMMARY.

Given the ability to maintain a uniform temperature in a factory during the winter, spring and autumn and throughout a large portion of the summer, the humidity which will be taken from an evaporating surface can be determined after a reasonable course of experiments. I believe there are no data in existence on which practice could now be based. The question as to whether or not this theory of air moistening can be put in practice may then be determined. I may venture to suggest that

the members of the Association may each set apart certain rooms, large or small, in which to determine the points at issue, and by comparison of their results we may reach a rule on which future practice can be established. The simplest way to try the theory would perhaps be to use a large bag of very open texture which after being boiled soft would take up spray and evaporate both within and without; if the lower end were closed and a good fan used, the air would be washed as it passed through the fabric.

The PRESIDENT. I will ask Mr. WOODBURY to tell us of his air purifying system, introduced under his direction at a large office building in Boston. Some of you may have seen it, but doubtless many have not, and I wish Mr. WOODBURY would go over the subject for a moment or two.

Mr. C. J. H. WOODBURY. The building to which reference was made is heated by the plenum system, by the air drawn down a flue or shaft and warmed by being drawn through a box containing steam heating pipes and then blown through the building, in which 467 persons are employed, and a portion is in continuous operation day and night. It is very important for them, as it is for all of us, that we should be provided with unvitiated air. Some of the apparatus in the building is especially susceptible to impairment by dust, and very careful measures were necessary to clean it. First, in regard to the purification of the air by removal of the dust. A frame-work was placed at the top of this flue, which is 37 square feet in cross section and 40 feet in height, and there were five tubes made of cotton cloth, which were six feet in circumference, giving in all an area of about 1,000 square feet. The air enters in the flue downwards through the tubes at a velocity of over 700 feet per minute; and at this great velocity it is deflected through the

wall of the tube, where on account of its greater area it passes through the cloth at a velocity of only 26 feet a minute; but on account of the great downward velocity, any foreign particles which it contains being heavier than the air, have a greater momentum, which tends to carry the foreign particles beyond the element of air which carries them, and striking at a very oblique angle beyond where this air passes through the cloth, this fine dust glances off and collects for the most part at the bottom. In using about 26,000 cubic feet of air a minute, day and night, the amount of dust filtered out of the air is about a peck or more a month. Most of the fine dust resembles the plumbago and anthracite dust used for foundry facings; it is very, very fine, and the particles are, apparently, for the most part, much smaller than the interstices of the cloth. Now, if the apparatus had been made so that the air should impinge normally against the surface of the cloth, the whole force of that air at the velocity of 700 feet per minute would tend to drive the small particles through and to clog up the cloth with large particles; but striking so that they glance and the cloth clears itself, those bags will last practically indefinitely in that condition. I have had them washed, but the shrinkage resulting from washing is an impairment, and when necessary they will be turned and beaten like a carpet. The tests of the apparatus as to results was made in two methods: first, by placing in the current of air a freshly painted board. The painter mixed up the paint so it would dry very slowly, and the board resembled fine sand paper from the dust adhering to it; after the bags were put in service, one-half of that board was painted anew, and there was no deposition of dust, and the fresh portion dried with a polish. The other test was by placing split laps of absorbent cotton, each about a foot square in various rooms of the building; and there was not any indication of dust on any of that cotton after four months' exposure in an ordinary office room.

In one of the large rooms where about 200 people are employed, there was enough dust carried by the soles of peoples'

shoes to deposit a very small amount of dust; but if the cotton had been placed before the inlet registers, I don't think there would have been any appreciable dust deposited there. The other part of the apparatus consisted in humidifying the air. The relative effect of the comfort to the human system is said to be more due to the humidity than the temperature; but as water will contain a great deal more heat than air, the same volume will carry more heat when humid than when dry. Certain portions of the building were difficult to heat and by putting this amount of water in the air we were enabled without any higher temperature to carry into that part of the building a larger amount of heat; and rooms which had hitherto been uncomfortable in the cold part of the winter were rendered very comfortable. Another feature indicating the greater comfort of the building was the absence in winter of the coughing by those employed there — a cough of the bronchial kind or from the larynx, a cough which ends with a squeal, which is so prevalent in New England during the winter, especially by those employed in offices. The amount of water put into the air was graduated according to the needs, the idea being to maintain a humidity of 50 per cent. of saturation at 70° temperature. That method of applying the water was by steam and not by the ordinary vapor of a weave room, but from the feed pipe to the engine a small pipe that gradually enlarged to a larger and a larger and a larger, like the drawing out of an old-fashioned spyglass, using as near the commercial size of the pipe as would permit the sequence of sizes which would cause the increase of area to be in proportion with the amplified volume of the steam on its way from a pressure of 90 pounds to the square inch to the atmospheric pressure.

The last section contained perforations on the cold side of these steam heating coils, and was exposed to the natural temperature, which might fall below zero. It was protected from the draft by a shield of hair felt. The air was moving at such velocity that there was only about $\frac{1}{14}$ of a second for the water to be taken up by the air, and it succeeded

in doing it. The steam pressure in the largest pipe which was perforated (or the diffuser) was but very little in excess of the air, merely enough to obtain the requisite velocity of efflux to accomplish the circulation; and the kinetic energy of liberation slightly superheated the steam; and practically I succeeded on the point which I had worked upon at my desk, and that is, that the steam could be superheated by the kinetic energy of efflux sufficiently to overcome the condensation. That amount was about 34 heat units to the pound, and as a matter of fact there was sufficient superheating to overcome any annoyance from drip.

The method of regulating the apparatus at first was by a hygrometer which was placed into the up-take flue of the heated air coming from the blower, but the engineer very soon reached a much simpler and more satisfactory method. You have heard of the nurse who did not wish a bath thermometer for the infant's bath; she could tell whether the water was too hot or too cold, because if the baby turned blue it was too cold, and if it turned red it was too hot; and very much on that same principle the engineer found that one room of the building on the northeast corner, was exposed by very large windows, and if there was too much steam being blown into the air he would notice the moisture on the windows of that room and so he would shut the steam down a little. If those windows were absolutely free from moisture he would perhaps let on a little more steam.

I cannot say very much more on the matter, except that I worked up the economy of the two ways of humidifying the air, the one being by blowing the steam into the air and the other by a diffusing spray of cold water. In either case the heat required is the same; that is to say, the water in the air that is in this room is as truly steam at the temperature of perhaps 70° as the steam in a boiler may be steam at 300°. It takes heat for that vaporizing of the water to convert it from a liquid to the gas in which it is sustained in the air. If a spray is blown into the air the amount of heat contained in the steam is con-

veyed to the air, and it tends, of course, to help heat the building. The difference between the two is because when we blow steam in the efficiency of the apparatus is perfection, or 100, because the equilibrium is established there at once. If we put in a spray we must use a larger amount of steam heating and in addition to the increase in heating plant there are losses amounting to perhaps 20 or 30 per cent. which are inevitable in all changes of energy.

The question of the evaporation of water by the air is simply a generation of steam at a very low pressure and temperature, and requires an expending of heat under the same general clause as those which govern the generation of steam, and as the steam in a boiler possesses at the same pressure identical characteristics, whether the heat comes from the burning of hard or soft coal, or petroleum, or even of heated gases, as in the case of a blast furnace, so in the evaporation of water in the air a certain amount of heat is required. If that water comes into the air from a source of steam at high pressure, there is an extra amount of heat, and a part of this is applied as far as may be necessary to produce this steam under conditions of the atmospheric pressure and the temperature of the surplus goes to heat up the air. The spraying of the amount of water used would have cooled the air over 20°, and would have required an increase in the steam heating pipes.

If, on the other hand, cold water is diffused into the air, the the same amount of heat is required to establish the original condition, but the temperature of the air is lowered, as in the case when water is sprinkled upon a floor in summer and cools the air by the absorption of heat necessary to volatize the water. This is also applied to the cooling of mill buildings in hot weather, by using old perforated sprinker pipes on the roof, and so much heat is absorbed by the volatilization of the water that the air in the vicinity does not absorb it rapidly enough and it cools the roof and the floor beneath it.

By taking advantage of these characteristics, there is an opportunity to use different methods of treating according to

the season, and while I believe that the steam spray gives the most satisfactory results in winter, because the air does not have to be heated to an unduly high temperature, in order that it should be comfortable after being cooled by the spray, yet in summer the use of the spray can be applied with great success in reducing the temperature of the air in buildings which are heated by the plenum system, merely by spraying the air in the flue on its way to the blower.

There are rooms in this country, particularly at the West, where the heat in summer is almost insufferable, that the natural temperature is reduced 10°, and a greater reduction would be feasible were it not felt that a lower temperature would not be as desirable, as the physical being of those employed there, to a certain extent, becomes assimilated to the higher temperature to which they are exposed outside their working hours.

Mr. EDWARD ATKINSON. I would like to ask one question. Mr. WOODBURY refers to 55 per cent. of saturation as the condition of health and I believe that is a fair standard for a dwelling house. In dealing with this subject in my paper I have made reference to a constant of 75 per cent. of humidity as the condition of good spinning. I have found that there is some variation in textile authorities on that point, and I should be glad if the members will state what they think is the exact degree of humidity for spinning and weaving, when this subject will be continued.

I would also remark that the reason for using the spray of cold water is that it is diffused through the atmosphere, which is of higher temperature. While if the air is subjected to an injection of steam at a higher degree of heat, it immediately goes for the cold windows or walls and is condensed. Cold water moistening is therefore essential in any system.

Mr. C. J. H. WOODBURY. Without assuming to answer the part of the question relative to the conditions of health, I re-

ferred only up to the conditions of comfort as were manifest by the appearance of those employed in the offices. The work of Dr. BILLINGS was taken as the standard authority on the desirable humidity. The measurements of the humidity were taken from hygrometers hung from a chandelier in the middle of the room. The temperature there is higher than nearer the floor and close to the windows. Quite near the windows the relative humidity was, of course, a great deal more; and if the humidity in the middle of the room exceeded 55 per cent., the humidity near the windows would be saturation and result in a deposition of moisture on the glass. The limit of 55 per cent. was taken because it was feasible under those circumstances to have an amount of humidity without any deposition of moisture on the windows except in very cold weather when it is reduced to 50 per cent. If the building had double windows it would have been feasible to maintain a higher degree of humidity if desirable, but moisture is not allowed to deposit on the windows.

In the paper read by Mr. DOBSON at the Crawford House meeting (Transactions, Volume 57), there is full information respecting the English law on relative humidity in mills.

The PRESIDENT. Gentlemen, will kindly give their attention for a moment. We will now give our attention to Mr. JAMES A. WALSH, of Lewiston, Me., who will read his paper on "Improved Methods of Drying Goods".

IMPROVED METHODS OF DRYING.

JAMES A. WALSH, Lewiston, Maine.

Mr. President and gentlemen, the topics of discussion at most of the meetings having been on subjects pertaining to the manufacture of goods, it was reasonable to expect that you would have an interest in some of the processes after the goods have been manufactured and before they were prepared for the market. Therefore one of the processes will be the drying method which has been one of the most troublesome ones and was selected, therefore, as the subject of this paper.

Although a large percentage of manufactured cotton goods pass through some part of a bleachery process before being placed on the market, and all manufacturers have an interest in the progress that is being made in improving the methods of bleaching, and facilitating the finishing of their goods, these matters have not heretofore received much special attention at meetings of this Association, but in order to introduce something of this character, it was considered best to select for the first paper a special work which we trust will prove of interest to all.

The subject suggested for this paper is "The Improved Methods of Drying", and all those familiar with bleachery work especially in the drying departments, cannot help noticing in passing through any well equipped establishment of to-day, the great improvement that has been made of recent years in this direction. Those who recall the olden days of dry sheds, when goods were hung up and promised for delivery in a week or ten days, and by some change of weather by which a dull, foggy

season of a few weeks set in, and delayed the goods so that they could not be delivered for perhaps a month, can appreciate the changes that have taken place, by which promises made nowadays for deliveries, can be relied upon to be carried out in a reasonably prompt manner, and if delays do occur, they are seldom occasioned by drawbacks in the drying departments. In the early days of drying cylinders, say about 1865 to 1870, when the colored work of an establishment was about the only kind dried on the cylinders, it was customary to have in some one-story building, a set of cylinders open on the sides and protected with a large hood or roof generally connected at the top with an ample outlet or flue extending up through the roof, and carried up high enough to make a good draft, and as fast as any vapors would arise from the goods on the cylinders, this good draft would carry them upwards and out, and excepting for some occasional drops of condensation which resulted from an unusually cold day, little trouble was experienced with the crude arrangements then in vogue.

As business increased and buildings of two or three or more stories high were needed, it become customary to locate the drying in the basement or perhaps one of the middle stories, and with the increased demand for prompt delivery of goods, it also became necessary to arrange for drying white goods on cylinders, as the dry sheds were fast becoming too unreliable for the requirements of business; and with all these changes moving rapidly one after the other, the arrangements for protecting goods when in the process of drying or immediately afterwards when waiting for subsequent processes, did not receive that careful consideration that experience proved should have been given to the subject, as the principal object seemed to be to get the goods dried, and do the best possible at the time to take care of them before finishing. Thus we find that it was a common occurrence in nearly all bleacheries, to have lapping cloths hung over the fans to keep the goods dry after leaving the cylinders, and then coverings to place over the goods that were laid up in bunches before being sent to the winders, as the dropping from

the ceilings from the condensation formed there, and also on the columns and walls of the rooms, made the old expression about the necessity of carrying an umbrella in the can rooms of bleacheries, seem to be by no means an unwise precaution. Many and very novel contrivances were used to avoid the difficulties arising from these troubles, but the remedies were as a rule only temporary, for exhaust fans placed in the sides of the rooms or on the sides of the sheathing over the cylinders and discharging through long flues out through the walls of the rooms only gave partial relief, and if the walls and ceilings were not thoroughly dried from the condensation of the previous day, it was almost impossible to get them dry during the progress of each day's work, especially on a moderately cold day. Those of you who have visited bleacheries about that time remember the hot rooms, full of vapors and the generally damp character of everything about the rooms which made them especially uncomfortable for those who were obliged to work there; and which occasioned frequent renewals of floors, sheathing and about all woodwork which could not withstand the constant wetting and drying which was continually going on. This condition of affairs also lessened the amount of work which the cylinders were able to perform, and the extra care necessary to protect goods increased very materially the cost of doing the work. But of late there has been a gradual improvement, and nowadays the drying rooms of most bleacheries are practically as dry and cheerful as are the finishing rooms.

Different methods have been employed at the various bleacheries, and some have been more successful than others, but at Lewiston we have been governed by the principles laid down in a circular issued some years ago by Prof. S. HOMER WOODBRIDGE* of the Institute of Technology of Boston, for the improvement of drying rooms of paper mills, and we have been very well pleased with the results attained, as we now have no trouble whatever from condensation in our drying rooms and

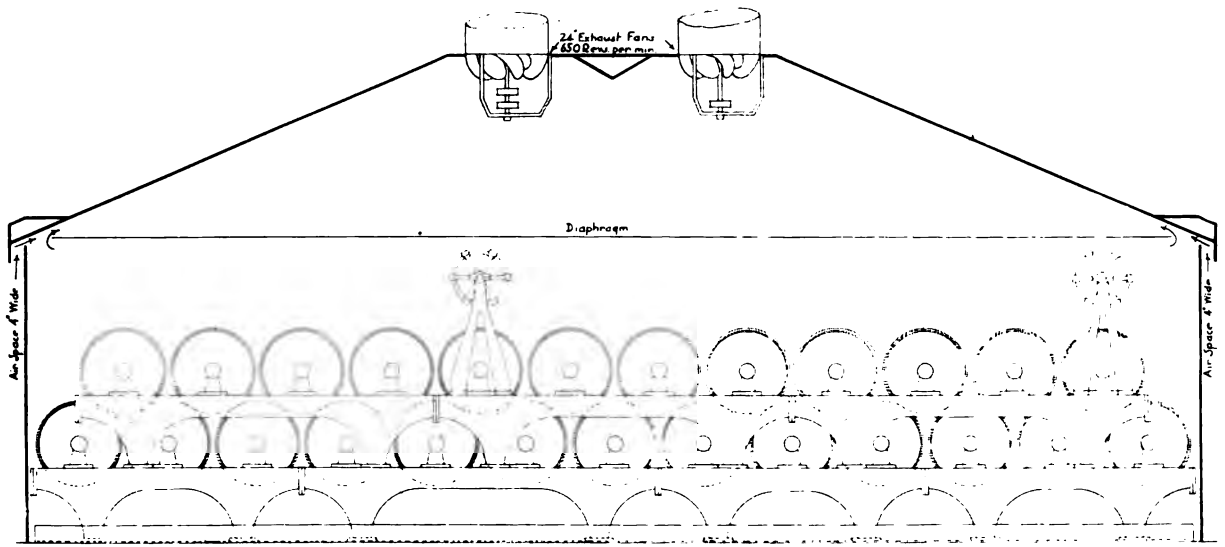
*Ventilation of the Machine Rooms of Paper Mills, by S. H. WOODBRIDGE, A. M. Boston, May 1, 1888. —*Technology Quarterly.*

always feel that the most delicate white goods, or colored goods, of any fancy shades are as perfectly safe in our can rooms as they would be on the tables in our finishing rooms.

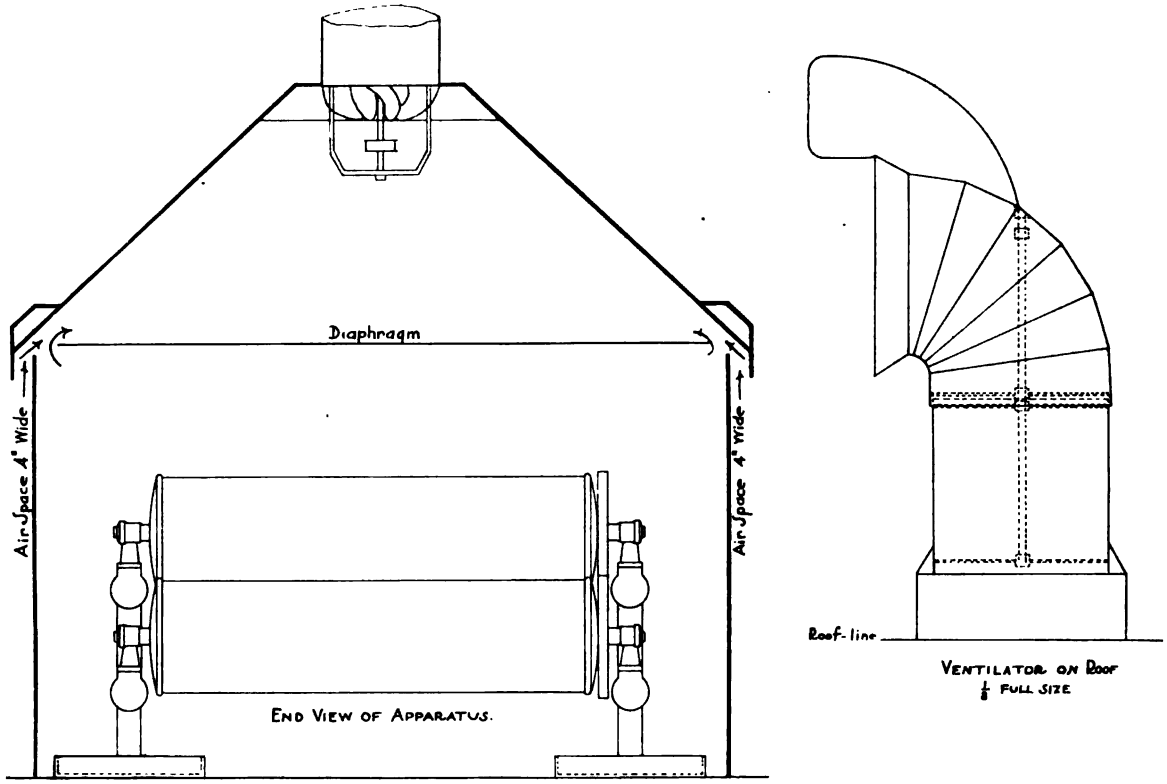
Our method for accomplishing this result has been to remove all fans from the walls of the rooms, and after sheathing the set of drying cylinders and carrying a pitched roof or hood to the ceiling, we have placed over the middle of the set two exhaust fans discharging directly into a flue on the lower room, and in the upper rooms into a revolving ventilator, which always carries the steam and vapors away with the wind and prevents any down drafts. When we discharge into a flue on the lower rooms we also attach at the top of the flue a revolving ventilator so that our outlets are all practically alike in discharging with the wind. In constructing the hood or roof we have carried out the edge about four inches beyond the upright sheathing on both sides and ends, and brought down an overhang about six or eight inches below the top of the sheathing and parallel to it. On the inside we have a diaphragm constructed of a light frame work covered with cloth, and which covers the space over the cylinders excepting about four inches on sides and ends, and as the steam and vapors arise from the goods when drying, they are carried along the smooth surface of the diaphragm to the outer edge, where they meet the current of air passing up through the opening between the upright sheathing and the hood, and are carried upward to the exhaust fans and discharged at once into the flue or ventilator, and this occurs so rapidly that no condensation ever forms even on the inside, as the surfaces are all moderately warm if the temperature of the room is maintained at about 65 degrees before work commences. We have drying cylinders on the lower, middle and top floors of several buildings, and we have equally good results on all floors by carrying out the principles of this arrangement as most practicable for each floor, as the same identical arrangement would not answer for all, for obvious reasons.

Our work comprises heavy bleached sheetings and all kinds of bleached shirting and pillow case goods, and colored cam-

brics, satteens, silesia, rustle finish taffeta linings and goods of that character, and all are taken care of equally well, with no thought nowadays of any trouble from condensation. We have given herewith a sketch of the general arrangement of one of our sets of horizontal drying cylinders which will illustrate the construction of the sides and hood, and give an idea of how we carry out in that case the principles mentioned as the basis for all our work in protecting our cylinders. All our fans are driven from the same shaft that operates the drying cylinders, and therefore are only run when the cylinders are in motion, but the revolving ventilator outside always faces the direction in which the wind is blowing, and that prevents any return draft and keeps up a fair current of air out through the opening in warm weather, but they are however all provided with dampers which are closed in cold weather, when the the cylinders are not in operation, and which prevents the exhausting of all the warm air of the rooms. Most of our drying cylinders are operated by cones driven from the regular power of the establishment, supplemented by an independent engine for each set or two sets of cylinders as it is practicable to arrange therefor. We use angular guides on all the cylinders where we do not need stretchers, and find a great saving in labor and also accomplish better results in drying, on account of avoiding creased goods and curled selvages. Within the past two years we have also adopted the Paul system on nearly all of our cylinders and find we have been able to materially increase our work and save much annoyance which formerly cost us lots of time and thereby expense. Since we have had this system in operation we can start up in the morning with the assurance that there need be no delays during the day to draw off condensation from the first cylinders of a set, as this system practically takes care of all the condensation as rapidly as it may form; and as the surfaces of the cylinders are practically maintained at about the same temperature across the entire width, we accomplish uniform work at all hours of the day and save the necessity of doing over twice, any goods that might happen to be dried when



THE LEWISTON METHOD OF REMOVING STEAM FROM DRYING CYLINDERS.



THE LEWISTON METHOD OF REMOVING STEAM FROM DRYING CYLINDERS.

the steam pressure was temporarily reduced by increase of work in the other different processes, which is something that bleacheries generally suffer from, even if it appears as though it ought not to be allowed. By the introduction of the Paul system in addition to the improvements previously mentioned, we are enabled to take goods directly from the drying cylinders and after an hour or so to cool off, can run them through our winders and have that process as well performed as though the goods had had 10 or 12 hours under old conditions to cool off. Since the introduction of the rustle finish during the last year or two this saving of time and also avoiding the necessity of drying goods over several times has enabled us to accomplish a great deal more work with the same machines than would have been possible under other conditions.

We are now able to dry the following classes of goods at the speeds indicated and do not require a steam pressure on our cylinders of more than four pounds when we are drying three or four strings at a time and of course reduce that very materially as we lessen the number of strings on the cylinders. On bleached shirtings we dry readily about 65 to 70 yards per minute. On bleached sheetings we will average about 40 to 45 yards per minute on $\frac{8}{4}$ to $\frac{10}{4}$ goods. On ordinary cambrics our usual average is about 35 yards per minute for colored work when we are drying four strings at a time, and on the goods that are starched for heavier finish we maintain the same speed by drying only three strings at a time. On silesias we show an average of about 40 yards per minute with three strings drying at same time. The temperature of our goods after being dried will, of course, vary with the different colors on dyed work, as blacks and dark browns will retain the heat longer than the lighter shades. We find our dark shades show about 98 to 100 degrees in the bunches immediately after coming from the cylinders. Our bleached wide sheetings will show about 95 degrees and bleached shirting about 90 degrees. But at these temperatures the conditions are favorable for the goods to cool readily before being sprinkled, and they will absorb the water

moderately enough to properly prepare them for the calenders.

This completes our process of drying and while we believe we have accomplished a good work for our own establishment, we are not sure but that others in our class of work may have accomplished as good results, and as the matter has now been introduced, we believe it would prove of interest to all the members of the Association if this topic or some other relating to bleachery work would be introduced at some of the later meetings of the Association by some of the other representatives from our New England bleacheries.

The PRESIDENT. Are there any questions to be asked of Mr. WALSH regarding his interesting paper?

Mr. OWEN. I would like to ask Mr. WALSH if he just left that little pin hole out that we talked of at the other meeting, whether the results would not be just as good? We want to take out our impurities.

Mr. JAMES A. WALSH. In my paper I endeavored to show that we were successful with the improvement that we had used; we did not care to discuss any particular improvements. If others have not been as successful as ourselves there may have been some other reason. We were not praising or dispraising any heating system; I simply mention what we have adopted and have obtained successful results.

The PRESIDENT. The next paper is on "Old Style Carding vs. New Style Carding", by Mr. JOHN R. MASON, of Fall River, Mass.

OLD STYLE CARDING VS. NEW STYLE CARDING.

JOHN R. MASON, Fall River, Mass.

In considering the difference between the old style and new style carding I shall not mention the difference in the cost or the number of hands required in either system, as this varies greatly in different mills, but shall confine myself strictly to the difference in the carding as I have found it by personal experience.

The improvements made in the picker machinery by attaching the feeder to the open picker, mixes the cotton better than was ever done when feeding by hand, providing we give the same attention to mixing the cotton when the bales are opened and the cotton pulled, and that we use the cotton the same way as we did when feeding by hand, that is, from the top to the bottom of the pile.

Under the old system the laps of the finisher picker were weighed two or three times a day; that is, we unrolled a lap and measured off one square yard of it and weighed it, and that was considered the weight of the lap. There was nothing very particular about it, as the doublings of the railway head and the evener of the head were supposed to even up whatever variation there might be. But under the new system one of the most particular places in the carding department is in the picker room, and the man in charge here must be trustworthy, for here, and only here can you do anything towards getting even work, for as the laps go from the picker room to the cards, so the roving and yarn will be, for there is nothing to even the work except what little the doublings may do. So if there is a great variation in the weight of the laps from the finisher picker, there will

also be a great variation in the roving and yarn, and it will be found hard work to keep the numbers right. Consequently the picker room becomes (under the new style carding), one of the most important places of the mill, and therefore the overseer of the carding room should see to it that special attention is given to this department.

When I was overseeing I had my "boss" of the picker room weigh every lap as they were taken off the finisher pickers, and any that weighed over one-half of a pound heavier than the standard weight that I had for my laps, I had him put back and run over again, and any laps that weighed over one-half of a pound lighter than the standard weight were served the same way. This is not as much work and does not take as much time as a person would imagine, for I had all my finisher pickers so they knocked off at the same time, and the boss of the picker room would push his scales to the first picker, and as the picker tender sprung out the lap he placed it on the scales and started the picker, while the "boss" weighed the lap and either put it into the pile ready for the cards or left it standing (for the tender to run over again) and was ready for the next lap by the time it was sprung out; and so on until all were weighed and put where they belonged, it requiring only a few minutes to do the weighing.

To make sure that he did this and that he might not get careless, I would often go out into the picker room and call my "boss" of the picker room up and have him weigh such laps as I would pick out of the pile of laps that were ready for the card room, and in this way I was always sure of the weight of my finisher laps and that no lap was put on a card over or under a certain weight. I also had the "boss" weigh the breaker and intermediate laps about twice a day and regulate them as near a certain weight as possible, doing which made the eveners on my finisher pickers have less work to do than they would have had to do had I paid no attention to the weight of my laps on the breaker and intermediate pickers. This, I believe, is the only way (unless you have railway heads) in which you can secure

anywhere near even roving and yarn by the new style carding, and therefore should have the constant attention of the overseer of the carding room.

The next differencc between the old and new systems is the cards. Under the old system of the wooden top flat card, there was not the amount of carding surface that there is on the revolving flat card. Again, the cylinder on the old style card tore the lap as it passed between the feed rolls, with an upward pull, which had a tendency to pull back or straighten the wire on the cylinder, making the cylinder do work that it was never intended to do, besides carrying all the leaf and dirt that may happen to be in the lap up by the tops, and what was not deposited on the doffer with the cotton was dropped between the cylinder and doffer; for if you look at the fly that is taken from under the old style card, you will notice that all the dirt is from under the doffer, while on the revolving flat card. The saw tooth lickerin strikes the cotton as it passes by the feed plate with a downward blow, knocking the leaf and dirt out of the cotton and depositing it on the floor under the lickerin and carrying the cotton to the cylinder, thus saving the cylinder the extra work of pulling the cotton to pieces and not pulling back the wire on the cylinder, as on the old style, and yet cleaning the cotton of leaf and dirt better than under the old style and doing it before the cylinder received it. Every overseer of a card room knows that under the old system, when the self-stripper on the card raised the top to strip it, a lot of fly would gather in the open space caused by the top being raised, which (when the top was again dropped into its place) was blown on to the cylinder, causing a thick streak across the sliver, besides letting dirt from the stripper get on to the cylinder. A great many overseers have tried to prevent this in one way and another. Someone suggested having a stripper made which would traverse very slowly from one top to another, but which would raise the top strip and lower it again with increased speed, so as not to have it raised from the cylinder long enough for much fly to gather in the open space.

Now on the revolving flat card the flats are constantly moving forward, carrying whatever dirt may have collected in them to the comb, where they are stripped without a flat being raised from the cylinder, and consequently there are no streaks in the sliver and no dirt getting on to the cylinder on account of the flats being raised from the cylinder. Then as the settings on the old top cards were anywhere from $\frac{1}{32}$ of an inch to $\frac{1}{16}$ of an inch from the cylinder, it depended altogether on the condition that the clothing was in. If that was in good condition the settings were closer than they were if the clothing was a little soft; and again, as the cylinders were not perfectly true, the settings could not be close, while on the revolving flat cards the cylinders being very nearly true, we set a great deal closer than on the top cards, our settings being $\frac{5}{1000}$ of an inch to $\frac{8}{1000}$ of an inch, in consequence of which we get a great deal better quality of work from the new system than we ever did from the old system.

The question has often been asked, Why is it that some men who have been very successful running the old style carding fail when they try the new style carding? I think from what I have observed that the reason is that they do not realize the difference between the two systems and therefore are unable to overcome the difficulties.

For instance, I have a case in mind of an overseer over the old style carding, whom the superintendent thought was the best or one of the best carders in the world, he did so well. After a while that superintendent went to another mill and took this overseer with him to start up a room with new revolving flat cards. In less than ten months these cards were making such bad work that there was talk of throwing out the cards and putting in a new make, as the cards were poor. Just at this time and before anything was decided on, that overseer left to take charge of a larger room and a man was hired to take his place, who, realizing what was needed, went to work on those cards, and the consequence was that in less than a year those cards were doing as good work as any in that city, and

that same corporation has since bought over 70 cards of the same make, showing that the fault was not because the card was poor but that the overseer did not realize the difference between the old and the new style carding. For while a good overseer may get good work from a poor card, yet a poor overseer may get poor work from a good card.

There are at least three things that should be required of an overseer of the new style carding. First, he must understand the cards in his room. This he can soon do by being among the cards a part of the time. Second, he must know when certain things should be seen to, and third, he should know that those things are attended to at the time they ought to be. For the new style carding requires the constant attention of the overseer to the grinding, setting, stripping and cleaning of the cards. The overseer who gives these things his personal attention and has a regular system for his work, so that one thing follows another, and the grinder and strippers know just what to do at certain times in the day, and therefore has everything kept in order, will not be the overseer who will make a failure of the new system but will be successful.

Another thing we have on the new system that we did not have on the old, is the combination draft on the fine roving frames. By this draft we can change $\frac{1}{10}$ of a tooth or $\frac{5}{100}$ of an inch of draft and should therefore (with the attention given to weight of laps) be able to keep our numbers quite even. Another difference between the old and new style carding is the general appearance of the cloth. Under the new system the cloth, by reason of the better carding (caused by closer settings on the cards and more dirt being taken out of the cotton), presents a cleaner and smoother appearance than it did under the old style of carding.

THE PURPOSE OF TEXTILE EDUCATION.

An Address at the Opening of the Lowell Textile School Year, commencing October 4, 1897,

By C. J. H. Woodbury,
Secretary to the New England Cotton Manufacturers' Association.

The broadest and most equitable judgments upon the American people, with their surprising new world answers to the old world problems, have not been made by any of ourselves, but by foreigners. The keen observations and accurate conclusions of De Tocqueville, Brice and Pidgeon upon the American people are records of deep insight, which form an essential part in any study of the characteristics of this nation, but still earlier testimony more pertinent to this occasion was given by LaFayette, while a guest of the country in 1824. He was deeply impressed with the development of the nation, and on many occasions stated his belief that its progress was due to that strength of purpose which was so generally an individual characteristic as to form in the aggregate a national trait. "Instead of keeping means of livelihood in the background," he said, "it is entirely proper (the polite Frenchman!) on meeting a man, to ask him what he does for a living. When a man is referred to, one may ask his vocation, and if one inquires of a young boy what is to be his occupation, it has been decided and he will tell you."

But this unity of purpose of life existed long before the pilgrimage of LaFayette; it anticipated the settlement of this country and reaches back to those who decided to cross the Atlantic, knowing but little of this wilderness, but knowing full well that here a living could be obtained only under the most severe conditions.

They were not beguiled like the Spanish adventurers with anticipations of El Dorado, and the fountain of youth, but expected a wilderness abounding in savages, devils, wild asses and unicorns.

The conditions of life were so severe that many of the Massachusetts Bay colonists returned, but the more vigorous remnant conquered the hostilities of nature.

From these progenitors the New England people have been bred to a line of industry, skill and frugality; and whatever may be true of the proverbial Yankee ingenuity, its fertility of mental resource, endowing its people with wisdom to plan and vigor to execute, is merely a logical sequence of human development through succeeding generations under a fixed purpose.

They knew that there was no premium upon ignorance, and on September 8, 1636, the General Court, "Voted: £500 to found a college," and two years later this grant was augmented by the bequest of Rev. JOHN HARVARD, who gave to it his library, half of his property, and which took upon itself his name. The amount granted was equal to the whole colony tax for the year, and EDWARD EVERETT stated that this is the first instance in history where the people voted public funds for education.

INSTRUCTION IN SPINNING BY THE MASSACHUSETTS COLONY.

But these forefathers meaning to build wisely in attending to the needs of the people, ordered the magistrates and deputies of the several towns, in May, 1640, to make known the "absolute necessity" which existed for the manufacture of linen. They were to ascertain the amount of seed in each of their towns, the names of the persons skilled in breaking, spinning and weaving hemp and flax, and to recommend what steps should be taken to instruct the young in spinning yarn and weaving cotton wool. It appears that this was probably the earliest of the industrial statistics which now serve such an important part in the world's knowledge of itself.

At the October session of the same year, a bounty of three

pence on every shilling's worth of linen, cotton or woolen cloth was voted, but this act was repealed in June, 1641, when the deputies were ordered to direct the people to gather wild hemp and to direct that all possible measures should be taken in families to spin as much as possible. They foresaw that a more systematic course was necessary, and June 14, 1642, passed the act for public education in "training up children in learning and labor," which provided for textile education, and was undoubtedly the first law for technical instruction, giving a manual training outside of the lines of book learning hitherto classed as the whole of instruction.

Let us cite portions of the law applying to textile instruction.

"This Court do hereupon order and decree, that in every towne, the chosen men apointed for managing the prudenciall affaires of the same, shall hencefourth stand charged with the care of the redresse of this evill (*i. e.*, neglect in training up children in learning and labor).

"They are to take care that such (children) as are set to keep cattle, bee set to some other impliment (employment) withall, as spinning upon the rock (the rock was a hand distaff), knitting, weveing, tape, &c. They are also to provide that a sufficient quantity of materialls, as hempe, flaxe, &c., may bee raised in their severall townes and tooles and impliments provided for working out the same: and for their assistance in this so needful and beneficiall impliment, if they meet with any difficulty or opposition which they cannot well master by their owne power, they may have recourse to some of the magistrates, who shall take such course for their help and incuragement as the occasion shall require, according to iustice."

These pioneers were more given to making history than to writing it, and it is but natural that we should fail to find any records indicating why this act failed to serve its purpose, but that such was the case is evident from the following act on "spinning", passed in 1655, setting forth in detail the means for instruction in spinning:

"This Court, taking into serious Consideration the present

streights and necessities of the Country, in respect of Cloathing, which is not like to be so plentifully supplied from forreign parts as in times past, and not knowing any better way or means conduceable to our subsistance, than the improving of as many hands as may be in Spinning Wool, Cotton, Flax, &c., doth therefore order, and be it Ordered by the Authority of this Court: that all hands not necessarily imployed on other occasions as Women, Girls and Boyes, shall and hereby are enjoyned to Spin according to their skill and ability: and that Select Men in every Towne do consider the condition and capacity of every family, and accordingly do assess them at one or more Spinners.

"And because several Families are necessarily imployed the greatest part of their time in other business, yet if opportunities were attended, some time might be spared, at least by some of them for this work:

"The said Select Men shall therefore Assess such Families at half and quarter Spinners, according to their capacities.

"And everyone thus aforesaid, for a whole Spinner, shall for time to come, Spin every Year for thirty Weeks, three pound a Week of Linnen, Cotton or Woollen, and so proportionably for half and quarter Spinners, under the penalty of twelve pence a pound short.

"And the Select Men shall take special care for the Execution of the Order which may easily be affected by dividing their several Townes into ten, six or five, &c., to appoint one of the ten, six, or five, &c., to take an account of their Divisions and to certifie the Select Men, if any be defective in what they are Assessed who shall improve the penalties imposed on such as are negligent for the encouragement of those that are diligent in this work."

These acts of the General Court indicate that the government was keenly sensible of the importance of maintaining a knowledge of the textile art. The action of town meetings and the records of selectmen's meetings indicate that this legislation was enforced.

The people showed not merely an appreciation of the importance of instruction in the spinning, but devoted themselves with enthusiasm to the subject.

THE TOWN OF BOSTON ESTABLISHES SPINNING SCHOOLS.

The action of the town of Boston deserves a reference as showing the amounts which the people were willing to appropriate for spinning schools.

At a meeting of the selectmen, Sept. 20, 1720, it was voted to insert in the warrant for town meeting, to be held eight days later, an article: "To consider a motion for setting up a Spinning School," and at the town meeting, the subject was referred to a committee, who submitted an elaborate report at the town meeting, Dec. 27, 1720, which recommended the establishment of a textile school with twenty spinning wheels, and included a scheme of premiums. The committee presented alternative plans of constructing a building especially for the purpose, or of hiring rooms in an available building.

This report was postponed until a later town meeting, March 14, 1721, when it was voted: "That the Selectmen conjointly with the committee have authority to let without interest not exceeding £300 for not exceeding seven years to such person or persons, who shal give Real Security for it and to Employ it for Carying on Spinning in this town."

In March, 1754, a town meeting voted: "To appropriate £50, old tenor, to improve the old town hall for a spinning school." This old town hall was built in 1656, and on the site of the Old State House, at the head of State Street.

At a town meeting held April 4, 1769, a committee reported in favor of a number of spinning schools, and it was voted that the town treasurer be authorized to borrow £500, lawful money, for the purpose; £200 of this amount was given to WILLIAM MULLINEAUX, to buy spinning wheels and cards, and £300 was to be lent to him to buy wool, as there were persons ready to purchase for their looms all the yarn which should be spun.

These citations could be continued at length for the purpose

of showing that the earlier legislation and its enforcement furnish numerous precedents for the action of the commonwealth in providing instruction in accordance with the needs of the times.

In the progress of events to the present day, let us still keep in remembrance those wise builders whose energies were not devoted to the erection of mills, but who laid the foundation for the industry by their appreciation of the importance of training up the young people to a knowledge of the textile art.

THIS USEFUL INSTITUTION.

This school is an institution with an aggressively useful purpose, endowed by the Commonwealth and enriched by gifts from those who appreciate the worth to be derived from its teachings. It complies with the requirements of the Greek philosopher who when asked: "What things are best to be taught to youth?" replied: "Teach youth those things which they will need when they become men." It is here, indeed, that the methods of textile manufacture are presented before you, but with the changed purpose that instead of being operated toward the final result of the cost of the product, the object of the work is to show how.

A mastery of the course would give one a rare knowledge of many things throughout the whole range of the textile art, and it is probable that many a successful textile manufacturer, if confronted with questions which could be readily answered by its graduates, would be in a position pictured by Dr. OLIVER WENDELL HOLMES when he doubted if one of the Harvard faculty could pass the entrance examination to the university.

There is a progress in the conditions of manufacturing. There is an assimilation of facts, until one is permeated by their spirit, which requires time, and forms the judgment of maturer years, and there is a knowledge of human nature, both an experience and an inspiration, which is essential to success in relations with mankind.

Practical experience is essential in any occupation, but such knowledge is limited by the surroundings under which it is ob-

tained. Here, instead of the associations of a single mill, are concentrated the means and information from a broad range, and this, when later applied in practical life, will enable the student to more thoroughly master the conditions of any one establishment, and to become more useful in his vocation.

President GARFIELD said that a seat on a bench with MARK HOPKINS in a log cabin would furnish the conditions of a liberal education. Be it so, but the duplicates of MARK HOPKINS are not so numerous as the pupils, and teaching is necessarily communistic.

PURPOSE OF TECHNICAL INSTRUCTION.

The purpose of any technical instruction is not to obviate the necessity of practical experience, but to broaden and render the graduate more useful — meanwhile water still remains a very useful element in which to learn to swim.

Technical instruction does not increase "handicraftness", nor does it enlarge the mental scope of the pupil, but it organizes the powers within one for maintained concentration of effort, and adds to the potentiality by furnishing the methods of learning many things from the experience of others, and enlarges the capabilities by avoiding the useless labor of an untrained mind.

Among the elements of personal experience, which each one must master for himself, there is nothing so entirely dependent upon the practice and observation of the individual, as the use of the hands. Dexterity is of the hands — handy. What amount of reading and study could inspire one to tie a weaver's knot?

A question which has often been discussed among the friends of technical instruction asks, which should come first, the teaching in the school, or the practical experience in the mill or shop? The best opinions on the subject appear to agree that there should be an alternation, and that technical instruction should be prefaced by a sufficient amount of practical experience to give a purpose to the work of the student, and to impress upon him the necessity of a further knowledge of the subject to which he proposes to devote himself for an occupation.

It is justice to the student and not disparagement to the institution that its functions should be correctly understood. Instructors can teach, but the student must learn for himself. This plant, covering the main points and principles of textile manufacturing, may well bear as a motto, "Tools to him who can use them." It should instill in its pupils such a grasp of principles and such details of application that its graduates may be enabled to follow careers of increasing usefulness, and, according to their capabilities, become captains of industry. The worth of all knowledge, especially when that knowledge is an element of value in a person's occupation, lies in its availability for ready use when desired.

THE IMPORTANCE OF ORGANIZING ONE'S SELF.

A physician once told me that every conscious impression on the brain was permanent, and that memory was merely the power of recalling a mental impression. There is such a multitude of demands upon one's memory that it is essential to organize personal experiences and observations, and in this connection the advice given me by Mr. JAMES B. FRANCIS is well worth your consideration. He advocated reinforcing the memory by systematic note-books, which should contain a record of items applying to one's occupation. The method of arrangement would be entirely one of individual judgment, the only suggestion being that it should be an accurate and available record of personal experience and observation.

For use in connection with keeping a record of work and study, especially sketches and drawings, it appears that the books containing the day and date at the top of each page, which were originally made for log books, serve a more convenient purpose for the first entry of each day's work and other memoranda than most of the books made for diaries or journals.

One of the most important requirements relative to the course of study and methods of instruction in this institution is contained in the annual catalogue [page 28] where note books are prescribed, a time set apart for entering up notes, and the state-

ment made that the care and accuracy with which these books have been kept will be considered in the final examination. The system followed by every business house of keeping a press copy of every letter written, should be applied to the personal affairs of individuals, the small roll copying books enabling this to be done without the use of the cumbersome copying press, feasible only in an office.

RESULTS OF INCREASED PRODUCTION.

The increased rapidity of production is furnishing the necessities of life with less work, and therefore it requires a smaller amount of labor for the individual to provide for his requisites than under the former conditions; but there is in each of us an inherent propensity to provide for one's self at about the same ratio of expenditure and income. The stimulus of increased purchasing power of one's labor inevitably causes larger purchases.

The truth of the statement that the luxuries of one generation form the necessities of the next, is illustrated in the biography of Dr. LYMAN BEECHER, where it is related that, during their residence in the Western Reserve, some eastern relative gave them a lot of carpet yarn, which Mrs. BEECHER wove into a carpet. After the carpet had been laid, one of the deacons called at the parsonage and stopped abruptly at the door of the room. "Come in," said Mrs. BEECHER. "I can't come in 'thout steppin' on 't," was the reply, as he entered on tiptoe and, laying his hand on Dr. BEECHER'S shoulder, said in deep concern, "Brother BEECHER, do you expect to have this worldly vanity, and the ineffable joys of heaven beside?"

Satisfaction with anything which can be improved is an indication of degeneracy. Ignorance is contented, and it is the divine discontent which has worked out the betterment of humanity. The British growl has been the making of that nation.

INCENTIVES ESSENTIAL TO EFFORT.

There cannot be any improvement unless there is an incentive in the promise of unusual results from a great effort. The exclamation of NAPOLEON that every soldier carried a marshal's baton in his knapsack, made armies victorious where mercenaries would have fled.

HORACE GREELEY said that when in an agricultural district in England, he saw a farm laborer chopping away at the grass with a bushwack scythe having a straight snath, and calling the man to the hedge, said, "My man, if you had a scythe a yard long and an inch and a half broad with a curved snath giving a good balance, such as we have in America, you could do twice as much work."

"May it please your worship," replied HODGE, "I do not have twice as much work to do."

In relating the incident, Mr. GREELEY added that there was more political economy in that sentence than in any other within his experience. When there is a possibility of advancement a man is stimulated by the fact that he does "have twice as much work to do."

THE OPPORTUNITIES OF THE TEXTILE SCHOOL.

This school has an opportunity to improve the standard of taste in design. People like to hear old songs, to be told what they know, and to gaze again on scenes consecrated by pleasant memories. Standards of beauty and taste are all built upon familiarity with that which we are accustomed to as a part of our race and civilization. These conventionalities impose such limitations of scope in design that a good designer must also be a good copyist, and show his skill by improvements on the original.

The fire-worshippers of the Orient twist a palm leaf to light the sacred fires of their religion, and this basis of a palm leaf in its conventionalized form is the groundwork in many Persian designs. In this connection I would recommend constant care

to the suggestiveness of your surroundings as furnishing themes for design.

The designing rooms of a celebrated French print works were in the office building in Paris, until the manager feeling that the designers were diverted too much by the attractions of the city, moved them to the works in the country. The product of the establishment immediately began to fall away from the standard. The reason was not far to seek. The designers, failing to receive the stimulus and suggestion from the pictures, colors and scenes of city life, had in like measure been impaired in the fertility of artistic resource. The department was moved back to the city with favorable results in the restoration of good designs.

The Boston Museum of Fine Arts will inaugurate in January, a department consisting of samples of fabrics mounted on frames so that they may be studied by those interested in textile design. It will contain the most complete collection which can be obtained from the looms of both savage and civilized races, the early cloths of Egypt and the best examples of goods bought and sold today. This collection will not be open to the general public, but is to be reserved for the use of students who are welcome.

What place could be more appropriate for the advanced study of textile design than in an institution devoted to the fine arts?

Taste asserts itself in raiment, and people will exercise taste in the selection of their clothing to the limit of their means. If foreign goods have the best designs and most pleasing colors, then foreign goods will be imported to meet the demand which will surely ensue. There can be no prohibitory tariff upon what ministers to excellence in taste, and nothing but an embargo can keep goods of foreign manufacture outside of our boundaries, if they are superior in design to our own.

A protective tariff will defend American wages, but it will not serve the interests of American capital, unless its investments are administered with skill in meeting internal competition. If the price of an article be increased through the provisions of a tariff, it can be of little avail, unless the same law also raises the

wages of its customers to a purchasing point. Marking up prices is not the equivalent of making a sale.

A clergyman, while visiting one of the Lowell mills under the escort of the treasurer, expressed wonder at the large supply of coal. He was told that this coal was only a portion of the annual consumption, and that the year's supply had been purchased for $20,000 less than for the previous year. "You have made a very creditable saving for the corporation," remarked the clergyman. "On the contrary, I should have preferred to have bought the coal for $20,000 more instead of $20,000 less; although as treasurer it was my duty to purchase the coal at its lowest market value. That difference in price was largely made up in miners' wages, and if those wages as a part of a general prosperity were higher, then the miners would have bought more cloth, and our mills would have had their share in the better sales which would result from such prosperity."

WEAVING AS A FINE ART.

A paper was read before the New England Cotton Manufacturers' Association, upon "Weaving as a Fine Art," and, when a member was asked, in accordance with the custom of that organization, to discuss the paper, he declined, saying that he proposed to confine his attention to "Weaving as a Profitable Enterprise."

Both were right; the function of a mill is to be a profitable enterprise, but if the operation of textile mills during the last few years has not required the exercise of all the fine arts known to those in the business, the condition of affairs has been universally misunderstood. There is competition in price and in quality of goods of every grade and variety which calls for the highest type of mental skill.

There are two desired elements in the production of goods, either of which will predominate according to the type of goods manufactured. In any line of standard goods, competition requires that the cost of production must be reduced to its lowest terms, not always in rates of wages, but in organization both of

mill and help, and in the judicious elimination of machinery which has become superannuated by long service or depreciated by subsequent invention. On the other hand, without detracting from the worth of any possible economy anywhere, in the manufacture of specialties, the elements of design and the color of the fabrics have become live issues.

At an early day the cotton mills were of better construction, with machinery and mechanical organization superior to the woolen mills, because in those plain cotton mills the problem was largely a mechanical question, while in the woolen mills matters of design and color in the fabrics were essential to success and therefore received the greater portion of the attention of the management who, at that time, may not have as fully considered the lesser advantages of cost of manufacture. In course of time each branch of the textile business has learned from the other. The later woolen mills and their equipment have represented the best engineering work, while the cotton mills making figured or dyed goods, have improved both the design and color of their product.

Far higher skill, with more satisfactory results to the owners, may be applied in the successful commercial production of less expensive goods, and it should be remembered that the millions have more money than the millionaires, and that they spend it more freely.

THE LINE OF TEXTILE INVENTION.

Most of the textile inventions are entirely in the line of obtaining an increased production, and the result has been beneficial in two directions: a portion of this increase has been applied to the diminution of the cost of the goods, and the remainder to the reduction of the hours of labor. The invested capital still struggles for its existence.

An India shawl is the result of many years of handiwork; the manufacture of a Paisley shawl requires about the same number of hours as the original shawl, which furnishes the design, required years.

At the Gobelins in Paris, a weaver makes about a square yard

in ten months, and while this product may not be duplicated, it is, nevertheless, the application of modern machinery to a similar fabric which has alone made the general use of carpets possible.

In considering an art of such magnitude as the manufacture of cotton cloth, one naturally turns to the time when the industry originated, as a means of estimating the rate of growth. It is hardly feasible to state the date of the first cotton mill, unless the statement is coupled with a definition as to what constitutes a cotton mill. As early a time as when the product of yarn was in excess of family requirement, and the space required for spinning wheels or looms being greater than the room available in the domicile, additions to the dwelling or a separate building were erected, might be claimed as the date of the first cotton mill. If this special building for any part of the process was operated by water power, then it was a little over a century ago that the first cotton mill was built; but if a cotton mill is an establishment where cotton is made into cloth by machinery driven by power, the Boston Manufacturing Company at Waltham, in 1815, was the first cotton mill in the world.

MORE PEOPLE USE HAND THAN MACHINE-MADE CLOTH.

Vast as is the product of textile mills all over the civilized world, and universal as is the use of cloth, yet the application of machine-made cloth has penetrated but little beyond those people who can be directly reached by railroad or deep water transportation, and the swarming population of oriental and barbaric nations still wear for the most part hand-spun goods. I have been in the mountain regions of western North Carolina, on the borders of that plateau larger than New England, whose people wear hand-spun cloth.

In the commercial sense, the industry of cotton manufacturing began within the memory of men still living — a work which had its inception in the fertile brain of FRANCIS C. LOWELL, who produced the complete mill organization in every detail, inventing a power loom and numerous important improvements in machinery, established corporation boarding-houses, societies for the education and entertainment of the help, arranged the

present method of selling the product, and established the precedents or the cotton manufacturing industry. All this took place during the last six years of a life marred by feeble health. Passing away at the early age of forty-two, he leaves as an epitaph, his name to this busy city, which continues his requiem in the hum of spindles and the crash of looms.

THE SOCIOLOGY OF COTTON MANUFACTURING.

This new cotton industry has solved some problems of sociology and raised new ones. It has added to the years of life by furnishing more suitable clothing. It has permitted the development of diversified industries by diminishing the amount of time required by the individual to provide clothing, but the problems arising from the concentration of subdivided labor organized into a unit for the single purpose of supplementing with brawn and brains the action of machinery in the output of goods, are still unsolved.

How much of the increment between raw material and product shall be distributed for the life work put into the fabric, and how much shall be left for that surplus of other labor, which has crystallized into the capital which builds, operates and maintains the vast plant?

Whatever may be the individual opinions on the equities of the division of this increment, it is a living fact that the employment furnished by these mills attracts to their service people from other vocations throughout this country, draws them across the frontier on the north, and from beyond the seas on the east.

And it is just as true that the profits to the mills have been merely sufficient to preserve financial stability in the conduct of business and the maintenance of the plant against its wear and tear, and against depreciation by subsequent invention. They are less than those of any other large investment and not comparable with the fortunes made in the mercantile marine of the last generation, which made accumulations at a rate pictured by EDWARD EVERETT as "beyond the dreams of avarice," and which later furnished the nucleus for establishing the mills in this city. Wages have increased, the hours of labor have dimin-

ished; the quality of goods has been improved, and the price reduced.

Goods made at Waltham in 1816, cost 30 cents per yard, and the corresponding goods have sold during the present year for 4¾ cents per yard.

As FRANCIS C. LOWELL solved the problem of the power loom in the attic on Broad Street, Boston, with cotton yarn on one side, and the fabric to be made on the other, so these social problems, which involve the most complex relations between man and man, must be solved by the force of thought, applied to present conditions, in order that labor and capital may best thrive in ministering to the advancement of civilization.

The whole trend of affairs, as applied to the textile art of to-day, is towards enlightened consideration in manufacture, excellence in design, and skill in dyeing, and for that purpose it is taking to itself the best in engineering, art and chemistry.

The three manufacturing nations of Europe, stirred by their own competitions, have established textile schools throughout their manufacturing districts, and let us confidently look upon this institution as embodying the best results for the American textile industry, and richly contributing to the progress of the completing century.

Francis C. Lowell.
DIED 1817.

FIFTH SESSION.

THURSDAY, OCTOBER 28, 1897, 2 P. M., AUDITORIUM OF THE PHILADELPHIA MUSEUMS.

Meeting called to order, President RUSSELL W. EATON in the chair.

The PRESIDENT. Certainly a debt is due to Professor WILSON for the words of kindness and for coming to our meeting at the Profile House last autumn, and for the opening of eyes in the paper he delivered before us at that meeting, which had such a strong effect that at its conclusion the Association voted unanimously that the Board of Government should be requested to arrange the meeting in Philadelphia this fall.

MOVEMENT AND STATISTICS OF COTTON GOODS.

PROF. WILLIAM P. WILSON, Director Philadelphia Museums,
Philadelphia, Pa.

It gives me great pleasure to welcome you to Philadelphia, a city of no mean achievements in the extent and variety of her manufactures. It gives me further pleasure to welcome you here on behalf of the Philadelphia Museums, and to offer you their service as fully as you may desire it.

The universal demand for cotton fabrics of all kinds, and from every quarter of the globe, makes the subject of the move and statistics of cotton goods a difficult one to treat, for in some countries there is a lack of exact information.

The exports of Great Britain are greater than those of all other nations combined in the line of piece goods. Trading in every part of the world, and some countries having practically a monopoly of their foreign business, Great Britain furnishes the best indication as to the course of commerce in cotton goods throughout the world.

In 1896 Great Britain exported 5,220,000,000 yards of cotton piece goods of all kinds valued at $256,000,000, being an increase of 190,000,000 yards over 1895, and a decrease of 112,000,000 yards as compared with 1894.

The United States exported in 1893, 143,000,000 yards valued at $11,809,000; and in the year ending June 30, 1897, 313,000,000 yards valued at $21,037,670, an increase of 78 per cent. over 1893. This is a great improvement for us, yet the total gain is small in comparison with the trade of Great Britain, being only about 3⅓ per cent. of her export of cotton goods.

Germany exported in 1895, $46,000,000 worth of cotton goods of all kinds, being an increase of $8,000,000 over the previous year. Of this $14,000,000 was colored or printed piece goods; $1,400,000 uncolored. Her rapid progress must be attributed to the excellence of her trade and technical schools, of which I shall have more to say later on.

In 1895, France exported $21,000,000 of cotton goods of all kinds, and Belgium exported $4,473,000 colored goods: $327,000 printed, $768,000 bleached; total, $5,568,000.

The main increase of exports for the United States has been in the trade with Asiatic countries and Australia. The increase for China during the last year was 60,000,000 yards, 73,000,000 yards having been taken in 1895-6, and 133,000,000 in 1896-97; in Asia and Oceania outside of Australia, India and China, the increase for the same time was from 5,900,000 to 33,710,000 yards. It is said that the increased importation of American cotton goods into China arises from the fact that, being heavy goods, they are more especially taken by Manchuria and northern China. These districts were most affected by the war with Japan, during which the amount of these goods absorbed was small. The increase in 1896 is, to some extent at least, due to the falling off in 1895. China took 542,000,000 yards in 1896, from Great Britain, or about four times the amount taken from the United States. This gives some idea of how large the Chinese market for cotton goods now is.

The Blackburn Commission of England reports that, while England has supposed that China's millions were clothed by English mills, it found in the far interior little in the way of foreign cotton goods. There people are poor and use their homespuns. Foreign goods but partially clothe the few who can afford to buy. For the mass of the people English and American cottons are articles of luxury. Yet this fact does not necessarily denote that there is no scope for extension of trade among them. The great drawbacks at present are the poverty of the people and the fact that their markets are supplied entirely through Shanghai and Hong Kong.

This Commission says that even under existing methods something might be done by sending into China new qualities of good makes of shirtings, which would be received as "new chops", and pushing them. This should not be done by patterns, as they are too insignificant to command proper attention and are likely to be lost or thrown aside. Sample pieces or small consignments would be better. If gray or bleached, send in ranges; if dyed, in assorted colors. Such samples are advised because the Chinaman is suspicious and critical in buying. He would be more favorably influenced by seeing the full particulars of what he is buying, than by patterns, although pressed with all the persuasive urgency of an accomplished salesman. These markets, if carefully worked, would probably enormously increase the demand for cotton goods in China. It is promising that American goods are already there and favorably received. The relative advance made by our cotton goods may be seen in the following statistics of imports of Shanghai. Pieces 40 yards each:

	Drills.		Sheetings.	
	England. Pieces.	United States. Pieces.	England. Pieces.	United States. Pieces.
1893,	427,000	422,000	728,000	903,000
1894,	257,000	720,000	470,000	1,257,000
1895,	269,000	537,000	642,000	891,000
1896,	201,718	1,214,000	1,123,802	2,248,000

The amount received there from other countries is small. In most other lines of cotton goods Great Britain exceeds the United States.

The importance of Chinese trade, in the eyes of Europe, is shown by the fact that England, Germany and France each has commissioners travelling in the provinces of that country to discover what possibilities there may be in the future with China. While much that they say is reported to the public, and therefore available to anyone, there is much, as remarks in themselves indicate, that is communicated only to parties inter-

ested, a precaution intended to prevent people of other nations reaping advantages from the information.

The question of widths and colors affects the sale of goods, and these are determined upon by the English and other European nations upon private information from agents and commercial missions.

Take the matter of color. The labels may be made so as to sell or prevent the sale of the goods. In the colors of labels it is well to avoid plain white, plain buff, and the combination of blue and white; these, to a Chinaman, being associated with death, and consequently unlucky. The Chinese favorite colors are red and yellow, the former being associated in the minds of the natives with rejoicing, the latter with dignity. The undraped or partially draped human figure should be avoided. Indeed, the use of the human figure at all in trade marks and labels in China is dangerous. Some detail quite harmless to us may have an ominous significance to the Chinese. Thus a green cap is a token to them of the greatest misfortune that can befall a man.

A gentleman of experience corroborates these views as to native tastes and superstitions, by suggesting that there would be a demand for colored cloths if manufacturers would study native tastes. He commends the following colors:

1. Light blue or lilac ground, with flowers in black.
2. Crimson ground with flowers of five colors — these for children's clothing.
3. Light blue ground with white flowers, for curtains and bed coverlets.

It is also suggested that if American drills were tanned so as to bear the wet without rotting, such might be ultimately sold in the empire in enormous quantities for use as sails, if produced at a low price.

In the Amoy district the cloth most generally in use is a strong, coarse, unbleached cloth, 22 inches wide and retailed at 4½ cents a yard. This is made by the natives in pieces of nine yards, and sold at about 36 cents a piece. As a general rule

the native cloths used for underclothing and linings are about 17 inches wide, and those used for outer garments about 20½ inches wide.

In Shanghai, 36, 32 and 24-inch wide cloths are the rule, in pieces of 24 yards in length. Color and widths, though seemingly small matters, are nevertheless important factors in the sale of the goods in this country. We dwell on China more particularly, because during the last year 42 per cent. of our manufactured cotton exports were sent to that country. England sent to China 12½ per cent. of her exports of cotton piece goods. Improvement in the condition of the Chinese will probably make the trade still more important. China takes $26,000,000 of cotton goods from England, an amount greater than the total export of cotton goods from the United States.

England's largest market is India. England sent $82,600,000 of cotton goods to India in 1896. In this trade India is the largest customer of Great Britain, taking about one-third of all of England's enormous export.

If Americans would look after this market, which seems to be too much neglected by them, they would surely secure a good share of this trade. The fact that it is an English dependency does not necessarily militate against us, for in many English colonies American goods in various lines are competing successfully with those of English and German merchants. The Germans are giving special attention to India and we should not be behind them in a country in which the commercial language is English.

In Australia, the amount of cotton piece goods imported from the United States increased from less than 1,000,090 yards in 1895-96 to 5,556,000 yards in 1896-97, and their valuation from about $67,000 to $305,000. This amount is of course small in comparison with England's 160,000,000 yards and $12,000,009.

In Asia and Oceania, outside of China and British Australasia, this trade of the United States has made gains, increasing

5,000,000 to 33,000,000 yards and in values from $344,000 to $1,600,000.

A strange commercial phenomenon is that while we make gains in Asia and Oceania, we fail to make corresponding gains in Mexico and South America. It would be natural to suppose that in these markets, which are nearer to us than to England, our advance would be as rapid as England's.

In the countries south of us, Mexico, West Indies, Central America, and South America, there is a population of over 50,000,000. To these countries England exported in 1896, about $40,000,000 worth of piece goods, one and one-half times as much as to China with its 300,000,000 people. Germany sent to these countries $4,800,000 worth; Italy, $2,500,000; Belgium over $1,000,000; the United States sent $4,400,000. This is about one-ninth of British cotton export trade with Latin America, instead of one-fourth as in China.

With Mexico, our next neighbor, England's trade in this line increases, while that of the United States is decreasing. England sent $2,244,000 in 1896, against $1,460,000 in 1894, while the United States sent $366,753 in the year ending June, 1897, a falling off of $128,000 from the previous year. Germany, too, is increasing her trade in these markets.

When we go to countries like Brazil, with her 16,000,000 population, which sells the bulk of her products to the United States, we might expect a better condition of trade in cotton goods. Yet in 1896 she took over $9,000,000 from Great Britain, $1,400,000 from Germany, and $619,000 from Italy. She bought from the United States in year ending June, 1897, $607,000 worth, being $300,000 less than in the preceding year. The same is true of Argentina, where England sells to the valuation of $8,000,000, Italy to over $1,000,000, Germany to about $1,000,000, and the United States to about $270,000.

With Venezuela and Central America the ratio of the United States trade to that of Great Britain is larger than in Brazil and Argentina, but still it remains true that we are far behind Great Britain in near markets. In these countries, the United States

is not even second, Germany leading her in some of them and Italy and Belgium in others.

For this various reasons are given: lack of banking facilities, need of American local houses, need of American steamship lines; but probably the only one of the many reasons given, not equally true of countries in which we are successful, is the fact that there English is not the commercial language. English and German dealers are familiar with the language of the countries where they engage in business; our own are not.

If our commercial and other schools could be induced to devote some time to Spanish at least, if not Portuguese, and if our traveling men were familiar with these languages, we should probably find it a great aid in developing trade with these countries. Philadelphia's great merchant-prince and philanthropist, GIRARD, was wiser than men of this generation, when he suggested in his will the teaching of Spanish in the college that he founded.

In a study of the different kinds of cotton goods exported, we find that Great Britain is losing ground in the lines of white goods, while she is gaining in colored, printed and dyed goods. British manufacturers claim that, in this way, they more than make up for any loss in uncolored goods. This changed relation of lines of goods they claim to be due to the improvement of their technical schools, in their attempt to make them equal to those of Germany. It is noticeable that Germany and Belgium export more colored than uncolored goods, and their success in foreign markets where they compete with the English, is in those lines in which technical skill, such as a knowledge of dyes and colors, is brought into play.

This furnishes a strong argument for the support of such textile schools as those in Lowell and Philadelphia, where the labors of Mr. SEARCH and others have brought technical art to such a state as to be able to claim that they are doing for America, what the Crefeld and other schools have done for Germany. Nor should our interest in textile schools make us

lose sight of the need of laying substantial foundations of education in our common schools.

While the textile schools will educate the superintendents, chemists, and heads of departments in mills, through whom new methods will be developed and the mass of workers directed, the common schools will increase the teachableness and capability of the operatives.

Art schools, museums, textile exhibits, everything that will raise workmen above the level of mere mechanical imitation, will result in advancing the character of American goods, and in maintaining the good reputation they have already won in many lands. In order to place their goods in markets where we already have a foothold, our competitors, both English and German, pay us the compliment of imitating our goods and labels, and selling as American cottons fabrics that never saw America.

In countries like Mexico, Brazil, Japan and China, cotton manufacturing has been taken up, and fears are entertained that this may interfere with the amount of such goods imported. Yet, while they take up certain lines of goods, more especially inferior grades, they develop at the same time a demand for more goods of better grades. In Mexico, increased imports run parallel with increased manufactures. In Brazil no serious attempt has been made to produce colored goods. The larger part of the output is sacks and other lines of goods in which color does not enter as a factor. We may set it down as a fact that there will always be a demand for the best goods, and we should so shape our plans as to be able to furnish the BEST.

England and Germany both look upon the United States as a dangerous rival in the markets of the world, because of its possibilities in the line of manufacture.

Foreign trade is essential to our standing among the nations of the world, as well as absolutely necessary to take the surplus of our mills, and therefore it is wise in us to use every honorable method to maintain our foreign trade, and to advance until we

are abreast with the new competitor for the world's markets, Germany.

Germany today is second only to England in the amount of her foreign commerce, and has attained this position by extraordinary strides in the last decade. While in the line of cotton goods, the United States is ahead of Germany in Asiatic countries, in South America she is behind. In taking the trade of the countries south of us into consideration, it might be well to review how Germany has succeeded and is succeeding in these countries. The only way to secure a larger share of the world's commerce is to "hustle for it", just as is done for the home trade.

Foreign trade will not come to us; we must seek it. We need an outlet for our manufactured goods, and that being the case it would be well to study how Germany has been able to secure such a large increase in her foreign commerce. She has not accomplished this by spasmodic effort, or because of any peculiar genius. It has been brought about by methods of which any other country can avail itself. She has built up an educational system which, although not perfect, is today the model which the world is imitating. She has recognized the importance of drawing and technical art in the common schools. She has also developed her trade and technical schools, especially in the line of textiles, and these already have proved their value by the results achieved.

In her trade schools, foreign languages useful in commerce are taught, and thus they are educating men who can go abroad as salesmen and gain the advantages to be derived from dealing with the people in their own language. German banking houses are being established in foreign cities, and local German business houses are opened in every prominent city in South America, and already there are more German local houses in some places than English, although they have not been so long established there. German salesmen understanding the language of the country are sent out in every direction, and make it their business to study the tastes and wants of the people. The home

manufacturers do not hesitate to make any changes in their goods necessary to adapt them to these tastes.

Germans subsidize the merchant marine and use every method possible to lessen the cost of freight, both on land and sea, in order that their manufacturers may place their goods in foreign countries more cheaply than the English can do.

They are establishing commercial museums in various cities in their own land, and like institutions in foreign lands, all of which aid in placing their products before foreign nations, and foreign products before their own people, and these are supported by the commercial bodies in various parts of Germany.

Briefly, then, the success of Germany may be attributed to two causes: first, a careful study of the local requirements of each desired market; and secondly, a systematic and painstaking effort to adapt its products to meet such requirements.

It is interesting to note the attention which is now being given to the China trade alone. England has a government commission there, studying and reporting on the markets; Germany has a commission for like work. The Chamber of Commerce of Lyons, the centre of the textile industry of France, has taken the matter into its hands, and its members have combined to send their best representatives to Chinese territory, and incidentally to report on the trade of the whole empire. So far as Cochin China is concerned, there is little doubt but that the commission will accomplish results similar to those attained by the Paris Chamber of Commerce's mission to Madagascar, which has practically established the supremacy of French trade in that quarter.

A representative of the Philadelphia Commercial Museum is now in China, making a careful study of the trade of that country, and building up connections with business houses and commercial bodies, which cannot fail to be advantageous to our country. Arrangements are also being made there to gather a full exhibit of goods suited to the Asiatic market, and to display American goods in at least one of the principal trade centers.

But the most careful study of commercial conditions is of

little value unless the manufacturers will profit by it and act upon it. It is the painstaking technical work in German schools and the prudent training of young men to fit them for business in foreign lands, which has aroused England to the fact that British trade supremacy is menaced, and must be maintained by imitation of German methods.

It is by the same means that we Americans must expect to win our share of the world's trade. We must find out what the world wants, and then be prepared to supply it. When these conditions are met, our natural advantages are such that we need have little fear of the result.

EXPORTS OF COTTON PIECE GOODS FROM GREAT BRITAIN ENDING DEC. 31, 1886.

	Grey or Unbleached.	Bleached.	Printed.	Dyed, or Manufactured of Dyed Yarn.
Germany,	19,299,600	14,602,200	20,000,100	12,421,100
Holland,	16,218,700	12,607,600	11,770,700	17,046,900
Belgium,	23,250,200	4,990,100	7,866,600	12,103,800
France,	7,562,300	7,471,400	4,195,600	5,176,300
Portugal, Azores, and Madeira,	7,999,100	21,334,400	2,451,200	4,876,300
Italy,	3,652,100	2,400,600	3,496,200	2,487,200
Austrian Territories,	717,100	971,200	489,700	1,042,600
Greece,	8,898,300	6,419,100	6,192.200	4,848,200
Turkey,	116,377,500	67,941,100	101,903,800	27,749,200
Egypt,	56,869,000	61,007,700	28,008,900	13,056.000
Algeria,	47,200	402,300	942,600	33,600
Morocco,	7,055,900	27,896,700	4,186,400	2,127,200
West Coast of Africa,	5,642,100	4,742,600	17,343,000	12,969,300
Persia,	5,892,200	3,206,800	10,353,100	1,814,400
Dutch Possessions, India,	27,265,600	31,321,000	70,892,000	12,823,500
Phillipine Islands,	2,018,400	13,173,400	9,016,800	5,929,700
China, including Hong Kong,	290,866,400	124,355,200	48,194,300	79,577,500
Japan,	50,240,600	13,423,900	13,026,200	28,793,000
United States,	3,646,400	16,733,500	4,557,600	31,060,800
Foreign West Indies,	2,724,000	21,784,600	13,062,400	7,542,000
Mexico,	239,000	26,132,000	16,837,700	6,916,600
Central America,	12,885,800	15,657,200	19,434,100	9,536.200
Columbia,	9,424,600	29,027,800	38,040,900	10,042,600
Venezuela,	2,302,900	18,682,100	22,271,500	7,266,200
Peru,	7,436,900	10,970,500	15,033,700	8,465,900
Chile,	12,678,200	22,440,800	18,506,800	16,021,800
Brazil,	6,348,400	47,300,000	82,441,200	30,667,000
Uruguay,	6,192,700	9,253,800	18,828,800	11,735,500
Argentine,	21,489,300	35,213,900	56,525,700	32,454,200
Gibraltar,	1,138,800	3,627,200	716,300	448,200
Malta,	1,754,700	2,981,100	1,001,000	996,800
British West Coast of Africa,	15,514,500	15,327,100	24,701,200	22,412,800
British South Africa,	3,822,700	9,836,700	17,284,800	19,785,400
Bombay,	283,685,000	230,631,200	139,296,100	75,926,200
Madras,	46,095,500	12,338,500	20,203,200	10,558,900
Bengal and Burmah,	889,673,500	203,211,200	58,349,900	68,052,200
Straits,	37,231,400	34,815,600	17,483,400	7,141,700
Ceylon,	8,022,400	3,723,000	4,575,100	1,076,300
Australasia,	19,097,100	40,161,200	46,100,500	54,757,000
British North America,	683,900	3,236,000	12,923,300	10,869,400
British West Indies,	7,517,300	17,970,800	12,792,100	11,975,100
Other Countries,	47,616,800	58,751,200	51,821,100	40,873,700
Total,	2,097,090,100	1,308,074,300	1,073,117,800	741,458,300

EXPORTS OF COTTON PIECE GOODS

	From Great Britain ending Dec., 1896.		From United States ending June, 1896.	
	Yards.	Value.	Yards.	Value.
Germany,	66,334,600	$4,536,100	2,394,732	$149,309
Holland,	57,637,700	3,812,305	86,066	16,428
Belgium,	48,210,700	3,894,085	21,938	1,909
France,	24,408,200	2,273,480	154,956	8,591
Portugal, &c.,	36,666,000	1,759,925	122,021	10,134
Italy,	12,036,100	974,875	14,432	1,472
Austrian Territories,	3,220,600	221,875	594,926	30,344
Greece,	26,357,800	1,473,205		
Turkey,	314,035,100	15,112,665	234,946	13,693
Egypt,	158,941,600	7,319,045	9,542	968
Algeria,	1,425,700	83,330		
Morocco,	41,266,200	1,917,600		
Africa West Coast,	40,697,800	2,236,790	175,971	11,404
Persia,	21,266,500	1,039,410		
Dutch Indies,	142,394,800	7,455,780	3,000	267
Phillipines,	30,138,300	1,232,045	18,823	2,527
China,	542,993,400	27,064,585	73,535,149	3,875,843
Japan,	105,507,100	6,334,500	1,440,553	92,830
United States,	56,001,000	7,011,720		
Foreign West Indies,	45,113,400	2,057,255	10,765,577	653,023
Mexico,	50,127,400	2,310,325	7,889,198	494,365
Central America,	37,513,300	2,517,535	10,900,201	587,567
Republic Colombia,	86,535,900	3,818,115	7,256,321	401,690
Venezuela,	50,522,700	2,303,920	11,268,474	646,308
United Kingdom,			7,869,779	588,476
Peru,	41,907,000	2,007,150	1,667,451	101,692
Chile,	69,647,600	3,374,885	12,304,802	624,230
Brazil,	166,757,200	9,314,385	12,526,551	991,185
Uruguay,	46,010,800	2,025,660	1,311,020	112,379
Argentine,	145,685,300	8,239,295	3,631,699	274,963
Gibraltar,	5,861,200	292,590		
Malta,	6,798,900	360,690		
British West Africa,	77,957,600	4,570,145		
British South Africa,	50,732,500	3,681,625	2,041,891	133,167
British East Indies,				
Bombay,	729,801,000	29,157,595		
Madras,	89,197,500	4,097,025		
Bengal and Burmah,	1,219,300,400	47,089,905	2,474,936	138,603
Straits,	96,681,400	4,410,790		
Ceylon,	17,396,800	899,388		
Australasia,	160,158,000	12,122,000	939,700	79,442
British North America,	27,697,100	2,005,785	19,605,804	1,189,615
British West Indies and Guiana,	50,300,800	2,526,155	5,050,791	313,665
Other Countries,	199,135,000	10,635,855	28,628,119	1,486,254
Total,	5,220,398,000	$256,111,980	225,139,368	$12,958,357

EXPORTS OF COTTON CLOTHS FROM THE UNITED STATES FOR TWELVE MONTHS ENDING JUNE 30, 1896.

	Colored.		Uncolored.	
	Yards.	Values.	Yards.	Values.
Austria-Hungary,			594,926	$30,344
Azores and Maderia Islands	63,476	3,470	66,992	4,236
Belgium,	8,850	794	13,088	1,115
Denmark,			143,606	12,607
France,	3,400	217	151,556	8,374
Germany,	1,488,323	86,938	906,409	62,371
Italy,	2,745	225	11,687	1,247
Netherlands,			86,066	16,428
Portugal,	51,926	3,108	70,095	7,026
Russia, Baltic and White Seas,			200	35
Sweden and Norway,			74,229	8,199
Roumania,	20,115	1,075		
Turkey in Europe,	5,249	476	16,486	1,296
United Kingdom,	5,662,967	347,946	2,206,812	240,530
Bermuda,	137,967	7,563	76,553	6,565
British Honduras,	557,997	30,745	472,549	30,225
Nova Scotia and New Brunswick,	35,124	2,409	2,740	346
Quebec, Ontario, etc.,	4,726,935	284,391	14,724,703	883,010
British Columbia,	294	31	10,760	638
Newfoundland and Labrador,	68,171	4,103	137,077	14,687
Costa Rica,	748,910	46,608	1,383,803	67,864
Guatemala,	445,290	29,894	1,607,261	100,766
Honduras,	1,144,070	56,477	1,358,687	71,315
Nicaragua,	353,017	20,014	599,966	36,628
Salvador,	92,549	6,414	3,166,748	150,596
Miquelon, Langley, etc.,			298	15
Mexico,	5,348,802	311,532	2,540,396	182,833
British West Indies,	3,547,123	187,655	1,137,116	68,752
Danish West Indies,	5,288	367	122,230	8,786
Dutch,	960,236	54,832	219,781	16,542
French,	1,141	65	48,219	3,958
Haiti,	5,567,840	332,692	969,735	77,200
Santo Domingo,	1,847,815	90,877	318,195	23,872
Spanish Cuba,	15,316	969	194,797	22,583
Puerto Rico,	371,241	11,785	123,743	8,663
Argentina,	878,849	40,637	2,752,850	234,326
Bolivia,	25,200	1,326	273,971	13,331
Brazil,	4,258,786	325,118	8,267,765	594,067
Chile,	384,244	21,028	11,920,558	603,102
Columbia,	5,435,986	291,200	1,820,335	110,490
Ecuador,	266,415	13,664	436,563	31,515
British Guianas,	260,384	18,381	106,170	8,873
Dutch Guianas,	6,484	618	66,440	674
French Guianas,	2,372	129	10,137	663
Peru,	813,558	51,898	853,893	49,794

EXPORTS FROM THE UNITED STATES—Continued.

	Colored.		Uncolored.	
	Yards.	Values.	Yards.	Values.
Uruguay,	348,185	22,209	962,835	89,170
Venezuela,	8,910,000	488,101	2,358,474	157,207
Aden,			9,072,467	467,192
China,			73,261,149	3,854,146
British East Indies,	379,200	20,282	2,095,736	118,321
Dutch East Indies,			3,000	267
Hong Kong,			274,092	21,697
Japan,	3,500	200	1,435,053	92,630
Turkey in Asia,	214,211	11,341	8,000	580
All other Asia,			2,098,250	103,205
British Australasia,	325,278	20,361	428,138	47,282
French Oceanica,	186,284	11,799		
Hawaiian Islands,	1,546,723	89,272	175,666	10,524
Tonga, Samoa, etc.,			5,280	310
Philippine Islands,			18,823	2,527
British Africa,	867,254	48,563	1,174,637	84,604
Canary Islands,	37,276	2,046	127,960	7,593
French Africa,			400	30
German Africa,			2,400	180
Liberia,	8,582	450	10,343	790
Madagascar,	57,232	2,630	9,158,788	462,000
Portuguese Africa,	122,642	7,668	34,404	2,496
Turkey in Africa,			9,542	943
All other Africa,	126,909	6,565	3,670,021	167,018
Total,	58,747,729	$3,419,158	166,391,639	$9,539,199

EXPORTS OF COTTON PIECE GOODS FROM UNITED STATES.

Twelve Months ending June,	1896.		1897.	
	Quantities.	Values.	Quantities.	Values.
United Kingdom,	7,869.779	$588,476	11,094,345	$830,421
Germany,	2,394.732	149.309	1,588.698	95,672
France,	154.956	8.591	663,346	33,233
Other Europe,	1,229.736	91,681	687,603	62,397
British North America,	19,705,804	1,180,615	29,460.860	1,775.483
Mexico,	7,899,198	494,365	5,577,808	366,753
Central America States and Br. Honduras,	11,930,847	648.546	11,581,098	599,126
Cuba,	210,113	23,552	291,263	25,008
Puerto Rico,	494,984	20,448	110,698	7,057
Santo Domingo,	2,166,010	114,749	1,837,647	92,831
Other West Indies and Bermuda,	12,793.229	794.977	13,453.938	794,708
Argentine,	3,631,699	274.963	3.262,983	270,844
Brazil,	12,526,551	919,185	8,331,326	607,019
Colombia,	7,263.321	401,690	6,736,924	382,546
Other British America,	27,945,871	1,572,683	36,257,078	1,364,903
China,	73,261,149	3,854,146	133,296,906	7,114.574
British Australasia,	753.416	67,643	5,556,829	305.348
British East Indies,	2,474,936	138,603	3,670,360	199,880
Other Asia & Oceanica,	5,963,602	344,042	33,710,341	1,600,233
Africa,	15,405,990	793,386	16,284,319	748,236
Other Countries,	9,080,445	467,707	78,674	5,350
Total,	225,139,368	$12,958,357	313,533,044	$17,281,620
Colored,	58.747,729	3,419.158	83,409.441	4,770,231
Uncolored,	166,391,639	9,539,199	230,123,603	12,511,389
Total,	225,139,368	$12,958,357	313,533,014	$17,281,620

THE MANUFACTURE AND EXPORT TRADE OF COTTON GOODS.

ARTHUR PARKINSON, 13 Gold Street, New York.

The subject of manufacturing or exporting cotton goods may or may not be interesting at this time, seeing that there has been some improvement in the home market, but the future of the cotton industry of New England has to be considered, and I will try to explain some facts that it will be well to ponder over, for anything which tends to improve the industry must not be trifled with.

The members of the New England Cotton Manufacturers' Association are not ignorant of the facts relating to the cotton industry of the South. It is well known that southern manufacturers, with the present conditions, can undersell or compete easily with the eastern mills on medium and coarse fabrics, and the future looks dark for New England. The facilities of manufacturing have been so increased that in many lines of goods the existing manufacturing establishments can produce a vast amount more than what the United States can consume, and it seems likely that each year will cause stagnation for the industry, and of course the usual stoppages of mills during certain periods. As a result of this continued competition in certain lines of goods for the home market, the prices are low, wages are low and tariff legislation cannot help matters, for the merchant and jobber will buy in the cheapest market, and that means southern looms will be engaged ahead and the New

England mills must take what is left. This means a bad state of affairs and must be remedied sooner or later. Some say why not change on finer goods? This can easily be answered by any intelligent member of this Association. There are many practical and financial points connected with that question which do not come under the title of this paper. Suffice it to say that the large number of old concerns in New England are in a much better position to consider the advisability of manufacturing some cotton goods for export, than they are for manufacturing very fine fabrics for the home market, and I propose to add a few facts in this connection in the course of my remarks.

Speaking of exporting cotton goods, it must be remembered that there are several large concerns in New England who are doing a big business with China, Mexico and South America; but the agents of these mills are in a better position than I to explain the profits of the business being done with said countries, and it would be interesting if any of their agents who are present could give us a statement as to the cost of producing some of the goods of which I give a few leading descriptions in this paper, and which are manufactured in Lancashire for the markets of China, India, South America, Japan, etc. The English manufacturers and merchants hold the markets of the world not by looking at things from a superficial point of view, but from the standpoint that where there is business they must have it, by putting in operation only what are practical and common sense business methods. They have not secured those markets on the principle of "paying low wages, and thereby securing a low cost of production", which is a common expression among mill managers of America. The truth of the matter of wages is that English manufacturers pay not less than 30 per cent. more to their employees than the German manufacturers do; hence it is not to be assumed that the method of competition lies in that directlon.

Another point further: I may add that the cotton weavers of Lancashire are paid the highest in the world for the amount of work they produce, and consequently the English methods

of competition for the world's markets are not known as fully as they might be by American manufacturers, or there would be better opportunities for the advancement of the cotton industry in this country. It is well known that erecting and equipping mills in England is cheaper in cost than anywhere else. Secondly, the labor is of a class who are taught from youth to be economical and follow the rules of the management; hence a great saving in cost of production. Other things might be noted, but I believe the greatest advantage to the cotton industry of Lancashire is that great institution The Manchester Royal Exchange, and I don't see why a similar mercantile exchange in New England would not only be a great advantage for the home market, but also for helping along a system of foreign trade. It has been done in England and it can be done here.

AN EXCHANGE.

I have heard American manufacturers claim that while an exchange is suitable for England it is not for America, because the former is a large exporter; but it is well to remember that there was little or no export trade from England previous to the establishment of a general mercantile exchange. The mercantile Exchange dates back to 1729, when Sir OSWALD MOSLEY, the Lord of the Manor of Manchester, undertook to provide one. This was the forerunner of that present celebrated institution, The Royal Exchange, which is known the world over. In the 18th century very little export trade was done. India was the greatest exporter at that time, for the East India Company was actually supplying the principal markets of the world. But in 1794 a number of merchants and manufacturers of Manchester, who had dealings on the continent of Europe, banded themselves together and formed a "Commercial Society". The objects of this "Society" were "to resist and prevent as much as possible, the depredations committed on mercantile property in foreign parts, detect swindles, expose chicanes and persons void of principle and honor in their dealings".

The "Commercial Society" was the origin of the present

Chamber of Commerce, which has been of the greatest advantage to Manchester merchants and manufacturers, as they have steadily promoted the safety of trade in all directions.

The names of all reputable firms are known, and the "battle axe" is wielded wherever a foreign concern has gained the unenviable distinction of being found unworthy of confidence.

The Manchester Exchange is the great meeting place in Lancashire, for the representatives of cotton industries and kindred ones. They have for their guidance, and displayed in conspicuous places at each end of the great hall, the prices of everything connected with the industry, including the prices of consuls, the rates of discount, the number of bales of cotton sold in the principal markets. Cotton spinners meet their customers, and manufacturers of cloth are there to meet the cloth merchants and printers, and the buyers from the East and West. Business is done very expeditiously and it is a common thing to receive a large order for yarns or cloth for shipment abroad, and have them delivered, packed and deposited in the steamer at Liverpool within one day.

The manufacturers also meet the representatives of supplies of every description, and it is easily seen that they can buy to better advantage because they can submit their samples for quotations to every representative of supplies, and the latter must supply the goods as per sample, or he is subject to be boycotted. Every manufacturer and merchant on the Exchange very soon knows the "feeling" of the market, not only of the home, but also the export trade.

The influence of the Liverpool Cotton Exchange is frequently "felt" during the day, and the spinners make the best of it, which causes the manufacturers much concern. An expert on the Exchange is very cautious in his dealings, especially a manufacturer of cloth, who has to watch the raw cotton as well as the manufactured cotton, and who is directly concerned in the transactions which follow between the merchants and buyers for India, China, Japan, Constantinople, South America, the Levant and other countries which consume British manufactured cottons.

The export trade of Lancashire has not been accomplished without the influence gained by The Royal Exchange or its members who are acknowledged experts in the business.

Now, speaking of mercantile conditions in America, it must be stated that they are on a different system altogether.

Why they should have so different a system I have not been able to find out, except that the New England mills in the past have been able to make money under any conditions, or in other words "the profits of business were in the goods, while today they are in the method". American mill treasurers generally are ignorant of buying and selling, and especially of the latter, and the mercantile houses reap the benefit of that ignorance.

How can manufacturers under present conditions "feel" the "workings" of the market? The merchants will always dictate the prices so long as the manufacturers meet them in the same spirit. The New England Cotton Manufacturers' and the Southern Manufacturers' Associations have no better time than now to make a strike for the betterment of conditions in the selling of goods. I need not call the attention of manufacturers to the conditions which prevail, for they are too well known. But I do feel that an exchange will benefit the industry of New England because manufacturers will thereby meet the buyers and jobbers direct and "feel" the market better. The city of Providence, R. I., would be a good place to locate a mercantile exchange. It is a shipping port, well located, and has a good harbor. A mercantile association under favorable auspices, where manufacturers and merchants could meet and transact their business, would be a strong inducement for foreign buyers to locate, other conditions being satisfactory.

The remarks of ex-president ARTHUR H. LOWE, that several textile associations might consolidate and organize a mercantile exchange, should receive favorable attention.

METHODS EMPLOYED FOR EXTENSION OF TRADE.

The methods chiefly employed in England for the extension of trade must be similarly employed here if international commerce is to be successfully accomplished. As for the desirability of exporting cotton goods to South American republics and other countries, all trade is desirable if made profitable.

The Columbian Exposition was not opened for the fun of the thing, but was a contribution of the world's economic advance. The Bureau of American Republics, the Philadelphia Museums and the National Association of Manufacturers are a combination of agencies for promoting trade, especially between the various countries embraced in the International American Union. In fact there are many "institutions" that are doing much work in this direction, and the fruits of their labor will be felt in the future of American commerce, but they could lend greater aid to manufacturers at the present time, if they prepared a table or a list of selling prices, and producing prices of manufactured goods in the various markets of the world.

A comparison of this kind would stimulate manufacturers to consider the export trade more seriously, and to compete for it to better advantage. While it is all very nice to be telling the American manufacturers what they must do, it would also be very nice for manufacturers to learn the producing and selling prices of goods made in England, Germany, etc., and sold in South America or any other country. This very desirable information is not forthcoming so fast as all the other voluminous suggestions. I believe in reaching outward more; but let us consider whether we can do so profitably in all cases. I propose to give some information about the producing of goods, the selling prices of goods in Lancashire for export, but I am ignorant of the prices obtained for these goods as sold in the South American markets, etc., and this desirable information must be supplied through the agencies that are instrumental in giving us so much information otherwise.

Much attention has been drawn to the usurpation by Germany

of a part of British trade in various parts of the world. The reason why German goods are replacing British goods to some extent, is because the German representatives adopt a plan of ascertaining accurately the likes and dislikes of the natives in those foreign countries, and they immediately arrange a plan to adapt the goods she supplies to suit the requirements. I believe that Germany makes her consuls more useful for purposes of trade than England or the other enterprising nations. They keep their manufacturers better informed on the wants of the markets in different parts of the world, and that alone will get the Germans a market for goods where otherwise they might not be successful. That policy is worth imitating by Americans.

It seems that commercial enterprise has become a national policy with foreign countries, and who will say that it ought not to be encouraged by the American government, whose consuls should be made more useful than they have been.

I should say that the officers of the National Association of Manufacturers, or the other agencies, should be instrumental in getting detailed reports which should give statistics and figures, and also state where there appeared any opening for American goods in any part of the world. Reports on cotton goods should of course be accompanied by samples, and should be delivered into the hands of manufacturers only. Any such information would be essential to help secure new business, and also protect or keep it when secured. It must also be remembered that there is little sentiment in business, and because a piece of cotton goods may come from this country, a manufacturer must not nurse the idea that it is better than made elsewhere, and must fetch a better price wherever it goes. A solid foundation for trade cannot rest on that idea. Ultimately the quality and cheapness of goods would carry the day, and this must be necessarily the motto of any firm who endeavors to supply cotton goods in other countries.

I should say that a system of barter by enterprising American merchants might be arranged with mutual benefit. Say to exchange cotton goods, etc., for rubber, hides and coarse carpet wool, coffee, etc.

SOUTH AMERICAN TRADE.

I have a tendency to discuss the trade relations of our neighbors more so than going into details about the far East. The reason is obvious, for if we can compete with better advantage against England in the Latin-American countries, we most surely can extend our trade more in the far East.

Great Britain has practically all the trade in cotton and woolen manufactured goods, especially with Nicaragua and Central America and Brazil. There are some textiles imported from the United States in Nicaragua which are liked very much for the quality and designs, but as a rule they cost more than cloths from England and are therefore unpopular only with the better portion of the people. But as a matter of fact there are some kinds of heavy duck and drills from the United States which easily compete with the British product.

The principal cotton cloth imports of South American republics are grey cloths, prints, shirtings, drills, lawns, fancy weaves, zephyrs, etc., and are of cheap manufacture.

Successive rebellions in some South American States have impoverished the people; their lands devastated thereby, and that causes them to live from hand to mouth. The purchasing power of the majority of the population being limited, cheap articles naturally find a ready sale. Business is nearly all done on credit, and the usual time allowed to wholesale buyers is from three to six months. Some of these buyers are generally in charge of small trading stations in small towns or villages, who in their town have to give credit, but on the whole they pay their obligations as they mature. Retail trade in the larger towns is all cash, aud since silver depreciates the tendency of all importers is to avoid giving credit as much as possible, so as to prevent losses through the fluctuations in exchange.

The want of better direct intercourse, the consequent delays, heavy freights, shipping charges, customs duty and town dues, and fluctuations in the rates of exchange enhance the cost of cotton goods considerably.

It will be noticed that under present conditions, which are miserable enough, we do some business with the Latin-American countries, and it seems to me reasonable to conclude that, given the fact that our manufacturers can and do sell cotton goods in competition with the world, they could with a systematic effort all around, do much more.

I believe a great many of the New England old mills could be economically changed to suit the manufacture of cotton goods for export to South America and other countries.

SIZING AND WEIGHTING.

The methods of Lancashire so far as manufacturing export cloths are concerned, need commenting on, but there are very able members of this Association who have served many years in the manufacture of cotton goods for India, China, South America, etc., and it is only proper to leave some of the important matters to their care. But one point I wish to advance in this connection is the Lancashire system of manufacturing cheap cotton goods for export. They are experts in Lancashire in the sizing of yarns, and no matter how poor the yarn, I have seen the slashing department change the appearances and very little difference is noted in the weaving department; whether the yarn was of good American cotton, or of East Indian and American mixed, few could tell. Certainly I cannot speak of this as being universal, for there are novices everywhere, but the majority of Lancashire mills can boast of having good men who know the methods of procedure and details of size mixings for every kind of goods. In fact it is the able handling of the sizing department in many Lancashire mills, which keeps the manufacturers' heads above the water, all other things considered equal. The methods of sizing in Lancashire varies in every locality, and it is well known that some mills size their yarns up to 100 per cent., but the object of weighting depends to a great extent on the price of the goods.

Cheaper the price, the more cheap the fabric. I do not con-

sider it a fraud on the part of any manufacturer to size heavy, especially as they are sold to the purchaser with the full knowledge of what he is buying. The rule of business is to supply the demand if possible, whether it be a cheap or an expensive article. In nearly all orders for export cloths the specifications call for a certain weight, and certain numbers of yarns are seldom stipulated.

This will be noticeable in the description of some of the leading kinds which I have appended.

A FEW LEADING DESCRIPTIONS OF COTTON GOODS MANUFACTURED IN LANCASHIRE FOR EXPORT ONLY.

The selling prices quoted are the average during the month of August, 1897.

Inches Wide.	Name of Cloth.	Counts of Threads per Inch.	Yards Length.	Nos. of Yarns or the Weight of Piece.	English Manufacturers' Selling Prices.
					s. d.
32	Printers,	64x64	116	32s Warp & 50s Filling,	12 or $2.88
	Shirtings for China and				
38	South America,	64x60	38½	8¼ lbs.,	4 4 or 1.04
35	India Shirting,	68x64	38	9¼ lbs.,	5 2 or 1.24
35	China Shiring,	64x56	38	8 lbs.,	4 5 or 1.06
38	So. American Shirting,	72x64	38½	10 lbs.,	6 4 or 1.52
38	Shirting,	70x68	38½	10 lbs.,	7 2 or 1.72
39	Japan and China Shirting,	64x60	38½	8¼ lbs.,	5 6 or 1.32
45	Shirting,	60x48	38½	9 lbs.,	4 8 or 1.12
45	Japan Shirting,	64x60	38½	9 lbs.,	6 2 or 1.48
	Jacconets for various			40s Warp &	
39	countries,	56x56	20	50s Filling,	2 0 or .48
44	Jacconets,	56x56	20	40s Warp & 50s Filling,	2 4 or .56
36	Mexicans,	72x72	24	8 lbs.,	5 3 or 1.26
32	Mexicans,	72x72	24	7 lbs.,	4 5 or 1.08
32	T. Cloth,	56x56	24	6 lbs.,	4 0 or .96
	Grey Dhootie for India,				
44	etc.,	104x92	45	9 lbs.,	7 2 or 1.72

PACKING AND SHIPPING.

When packing cotton goods for export they must not be put in too slight packages, or they are subject to be damaged, and consequently rejected by the importer.

The packing houses of Manchester are remarkable institutions. Besides packing goods for export they do the work of sorting the pieces and making them ready for the special markets for which they are intended.

A well known writer says: "It is like scanning the index of an atlas", when looking over the business directory of a Manchester shipper. Suffice it to say that they send goods all over the world, and the packing establishments must vary the form and the make-up of the packages according to the requirements of transportation where they are received, such as in South America in some parts, where the burro and the mule are largely in use for the carrying trade.

The shipping clerks in Manchester packing houses are familiar with all the languages, bills of lading and exchange, and adjustment of values between various forms of currency.

It is wise to use the best materials of tarpauling, canvas, hoops, etc., for packing goods, and they are sure to reach their destination as safely as possible.

TRANSPORTATION.

There are regular sailings from this country to the Antilles, Mexico, Central America, and the north coast of South America, so that there are ample opportunities for transportation. It seems that freight rates depend largely upon the demand at a given time for shipments, and as the freight rates vary so much I cannot include a list of rates which would be acceptable, but at any time they can be obtained from the New York Commercial Journals.

There are about twenty steamship lines running to the River Platte ports from Great Britain, Germany, France and Italy, that afford constant means of transportation to all South American

countries. The European countries have consequently an admirable system of transportation.

There is very little difference of freight rates between Liverpool to South American ports, or New York to South America.

PEACE AND POLICY.

One disadvantage that American manufacturers who are seeking an export trade, will meet with, is the strong protective laws of America, which have the effect of artificially raising prices of mill supplies of every description, and everything has a tendency to increase our cost of production. When it is a question of home competition in cotton goods, rather than the competition of the world, I think manufacturers will see that too high a tariff must redound to their disadvantage. A few years ago this statement would not carry weight, but conditions are far different, and must be governed accordingly. The principal, and I think the only parties who are benefitted are the commission merchants, supply houses and machinery firms.

We are told by Mr. EDWARD ATKINSON that the advantage over England in cotton varies from 6 to 8 per cent. in favor of New England, and if we had a nominal tariff on the importations of cotton goods, would it not be of sufficient advantage for the manufacturers here? I beg to be excused for touching on the tariff, but there has been much discussion of the unfairness of the Argentine Republic discriminating against the United States, by increasing the duty on goods coming from this country, and said rates being much higher than accorded to goods coming from England, Germany or Italy.

This is only a case of tit for tat, for the United States imposes a heavy duty upon the Argentine commodities, and I fail to see the advantage gained by either government.

AMOUNT AND VALUE OF BRITISH TRADE WITH LATIN-AMERICA, COTTON GOODS ONLY.

Quantities and values of *grey* cotton piece goods exported from the United Kingdom to Mexico and South America, for the year ended December 31, 1896:

To	Yards of Cloth.	Value in Dollars.
Mexico,	239,000	$11,000
Central America,	12,885,000	440,000
U. S. of Colombia,	9,424,600	350,000
Venezuela,	2,302,900	105,000
Peru,	7,436,900	280,300
Chile,	12,678,200	460,000
Brazil,	6,348,400	260,400
Uruguay,	6,192,700	251,000
Argentine Republic,	21,489,300	890,000
Total Yards,	78,997,000	$3,048,200

Quantities and values of *bleached* cotton piece goods exported from the United Kingdom to Mexico and South America, for the year ended December 31, 1896:

To	Yards of Cloth.	Value in Dollars.
Mexico,	26,132,000	$1,110,000
Central America,	15,657,200	650,000
U. S. of Colombia,	29,027,800	1,210,000
Venezuela,	18,682,100	775,000
Peru,	10,970,500	485,000
Chile,	22,440,800	1,035,000
Brazil,	47,300,000	2,095,000
Uruguay,	9,253,800	830,000
Argentine Republic,	35,213,900	2,305,000
Total Yards,	214,678,100	$10,495,000

Quantities and values of *printed* cotton piece goods exported from the United Kingdom to South America and Mexico for year ended December 31, 1896:

To	Yards of Cloth.	Value in Dollars.
Mexico,	16,837,700	$755,000
Central America,	19,434,100	880,000
U. S. of Colombia,	38,040,900	1,630,000
Venezuela,	22,271,500	1,035,000
Peru,	15,033,700	760,000
Chile,	18,506,800	1,002,000
Brazil,	82,441,200	4,960,000
Uruguay,	18,828,800	995,000
Argentine Republic,	56,525,700	2,996,000
Total Yards,	287,920,400	$15,013,000

Quantities and values of *dyed* (or manufactured of dyed yarn) cotton piece goods exported from the United Kingdom to Mexico and South America, for the year ended December 31, 1896:

To	Yards of Cloth.	Value in Dollars.
Mexico,	6,916,600	$420,000
Central America,	9,536,200	535,000
U. S. of Colombia,	10,042,600	620,000
Venezuela,	7,266,200	380,000
Peru,	8,465,900	475,000
Chile,	16,021,800	865,000
Brazil,	30,667,000	1,990,000
Uruguay,	11,735,500	890,000
Argentine Republic,	32,454,200	2,045,000
Total Yards,	133,106,000	$8,220,000

Quantities and values of *grey* cotton piece goods exported from the United Kingdom to Mexico and South American countries, for the fiscal year ended June 30, 1897:

To	Yards of Cloth.	Value in Dollars.
Mexico,	127,500	$5,500
Central America,	5,414,900	181,900
U. S. of Colombia,	3,277,000	114,800
Venezuela,	1,355,400	58,900
Peru,	2,531,600	94,300
Chile,	8,532,200	294,900
Brazil,	1,563,000	65,100
Uruguay,	1,481,600	67,000
Argentine Republic,	7,841,300	295,500
Total Yards,	32,124,500	$1,177,900

Quantities and values of *bleached* cotton goods exported from the United Kingdom to Mexico and South America, for the fiscal year ended June 30, 1897:

To	Yards of Cloth.	Value in Dollars.
Mexico,	8,610,200	$388,200
Central America,	6,304,300	254,500
U. S. of Colombia,	13,563,300	558,000
Venezuela,	9,715,000	389,400
Peru,	4,356,500	192,500
Chile,	13,807,600	606,000
Brazil,	18,435,600	760,900
Uruguay,	2,506,300	140,300
Argentine Republic,	14,339,100	917,300
Total Yards,	91,637,900	$4,207,100

Quantities and values of *printed* cotton piece goods exported rom the United Kingdom to Mexico and South America, for the fiscal year ended June 30, 1897:

To	Yards of Cloth.	Value in Dollars.
Mexico,	6,137,500	$273,500
Central America,	6,585,200	299,100
U. S. of Colombia,	18,117,400	747,400
Venezuela,	8,775,000	406,300
Peru,	4,783,800	243,800
Chile,	8,701,900	438,700
Brazil,	26,446,700	1,469,500
Uruguay,	4,610,400	193,900
Argentine Republic,	11,784,000	653,400
Total Yards,	95,941,900	$4,725,600

Quantities and values of *dyed* (or manufactured of dyed yarn) cotton piece goods exported from the United Kingdom to Mexico and South America, for the fiscal year ended June 30, 1897:

To	Yards of Cloth.	Value in Dollars.
Mexico,	2,500,500	$161,300
Central America,	3,248,900	183,800
U. S. of Colombia,	5,108,100	295,600
Venezuela,	3,194,100	161,200
Peru,	2,802,800	152,800
Chile,	7,713,500	367,200
Brazil,	11,349,100	688,200
Uruguay,	1,832,600	119,100
Argentine Republic,	6,743,800	443,100
Total Yards,	44,493,400	$2,572,300

Appended is a statement of customs duties on cotton goods in Central and South American countries. Some of the South American tariffs contain very minute provisions for duties on the various classes of cotton goods, but instead of attempting to give the tariffs on everything in cotton fabrics, I have selected the principal articles and give the duties upon those, with the equivalent in United States money and quantities.

We are indebted to Mr. THEODORE C. SEARCH, of Philadelphia for the particulars.

ARGENTINE REPUBLIC.

Unbleached cotton cloth, 20 per cent.
Bleached cotton cloth, 25 per cent.
Colored or printed cotton cloth, 25 per cent.
Cotton yarn for weaving, 2½ per cent.

BRAZIL.

Cotton yarn for weaving, 15 per cent.
Cotton flannels, 48 per cent.
Muslins and cambric, 48 per cent.
Unbleached cotton cloth, plain or twilled, 60 per cent.
Bleached or dyed cotton cloth, plain or twilled, 60 per cent.
Shirtings, white or dyed, 60 per cent.
Ginghams, up to 12 threads per square of 5 millimetres, 60 per cent.
Ginghams, more than 12 threads, 48 per cent.

CHILE.

Cotton yarns exempt from duty for a period of five years from February 13, 1896; after that time duty will be 15 per cent. What are specified as "common class" of cotton goods are dutiable at 15 per cent. All others pay 25 per cent.

COLOMBIA.

Grey cotton tissues, 40 centavos per kilogram (about 8.4 cents per pound).
Blue salampores and white shirtings, calicoes, madapolams, etc., 50 centavos per kilogram (about 10 cents per pound).
Drills and other cotton tissues, white or colored, not otherwise mentioned, 60 centavos per kilogram (about 12.5 cents per pound).

COSTA RICA.

Sheets, blankets bleached, madapolam and transparent tissues, 33 centavos per kilogram (about 7 cents per pound).

Drills, ticking and mixed tissues, 43 centavos per kilogram (about 9 cents per pound).

Calicoes, osnaburgs, cretonnes, percales, muslins, etc., 54 centavos per kilogram (about 11.5 cents per pound).

GUATEMALA.

Cotton ticking, 50 centavos per kilogram, gross weight (about 10.5 cents per pound).

Thick stuff of cotton, for clothing, white or colored, 1 peso per kilogram, gross weight (about 21 cents per pound).

Cotton drill, 50 centavos per kilogram, gross weight (about 10.5 cents per pound).

MEXICO.

Raw and bleached cotton cloths, of smooth texture, not exceeding 30 threads in warp and woof in a 5 millimetre square, 6 cents (silver) per square metre.

Ditto, exceeding 30 threads, 11 cents (silver) per square metre.

Cotton cloths, painted, stamped or dyed, of smooth texture, not exceeding 30 threads, 12 cents (silver) per square metre.

NICARAGUA.

Domestics, plain, unbleached, 7 centavos (about 3.25 cents per pound).

Domestics, with colored stripes or checks, 10 centavos (about 4.6 per pound).

Ticking, unbleached or bleached; figured cloth ticking, blue, coffee-colored or with colored stripes, 9 centavos (about 4.18 cents per pound).

Prints or chintzes, 18 centavos (about 8.37 cents per pound).

Ginghams, 18 centavos (about 8.37 cents per pound).

PARAGUAY.

Tissues of cotton of all kinds, 20 per cent.

Calico and percale, 20 per cent.

Additional duties amounting to 12 per cent. are levied.

PERU.

Cotton sheeting, plain or twilled, exceeding 1.20 metres in width, gross weight, 40 centavos per kilogram (about 8.5 cents per pound).

Gray cotton stuff, plain or twilled, same as above.

Cretonne, chintze, etc., same as above.

SALVADOR.

Unbleached cotton cloths, 20 centavos per kilogram (about 4.2 cents per pound).

Bleached cotton cloths, such as madapolam, domestics, calico, sail cloth, etc., 40 centavos per kilogram (about 8.4 cents per pound).

URUGUAY.

Cotton cloth of all kinds, unbleached and white, 15.5 centavos per kilogram, net weight (about 3.28 cents per pound). Tare allowance of 5 per cent. on goods imported in bales.

Note—While this paragraph appears to be very broad in its scope, a great variety of fabrics are specifically provided for in the tariff.

VENEZUELA.

Unbleached cloths, including those covered with stripes or patterns, 1 bolivar, 25 centimes per kilogram (about 11 cents per pound).

Cotton drills, white or colored, and cotton flannels, same as above.

Chintze, calico, cretonnes, 2 bolivars, 50 centavos per kilogram (about 22 cents per pound).

BOLIVIA.

Cotton piece goods of all kinds, plain or printed, 30 per cent.

ECUADOR.

There is no specific provision for cotton goods. The rate of duty on all articles not specially mentioned is 25 centavos per kilogram (about 5.3 cents per pound), plus a surcharge of 20 per cent. Additional duties for local purposes are imposed at several ports.

IMPORTS OF COTTON GOODS.

Kinds and Qualities of Foreign Cotton Goods which are brought into the American Market every Year.

FRANK P. BENNETT, Boston, Mass.

The foreign manufactures of cotton now imported into the United States consist quite largely of fabrics in which needle-work rather than weaving was or is the characteristic feature. Out of a total of $34,429,363 of imports of cotton manufactures into the United States, in 1897, only $4,600,000 consisted of cloths, the principal items being, of course, prints, organdies and other dress goods, or undyed fabrics in which very fine yarns were employed.

The imports of laces, edgings and embroideries, in 1897, were valued at $12,500,000, and of knit goods at $5,596,000. The imports of cotton plushes and cotton velvets, in recent years, have risen above $2,000,000 per annum.

As the production of cotton goods (exclusive of knit goods) in the United States may be expressed in round numbers as $300,000,000 per annum, it follows that the imports of foreign cotton goods are equivalent to but 10 per cent. of our domestic production. The value of the products of the Amoskeag Manufacturing Company is about $6,000,000 per annum, and hence the domestic manufacture of such goods as are now imported, would be equivalent to the employment of five new corporations of the magnitude of the Amoskeag Manufacturing Company; but the total imports of foreign cotton cloths are less than the production of a single mill like the Amoskeag;

the other imports of cotton fabrics equivalent to the production of more than four corporations of the capacity of the Amoskeag, consisted, as I have already stated, of fabrics which, in the days of hand labor, were the product of the needle rather than the loom.

In the new tariff law, now in force in the United States, the following additional paragraph has been inserted:

"313. Cotton cloth in which other than the ordinary warp and filling threads have been introduced in the process of weaving to form a figure, whether known as lappets or otherwise, and whether unbleached, bleached, dyed, colored, stained, painted, or printed, shall pay, in addition to the duty herein provided for other cotton cloth of the same description, or condition, weight, and count of threads to the square inch, one cent per square yard if valued at not more than seven cents per square yard, and two cents if valued at more than seven cents per square yard."

The following paragraph was also inserted in the cotton schedule:

"312. Handkerchiefs or mufflers composed of cotton, whether in the piece or otherwise, if not hemmed, or hemmed only, shall pay the same rate of duty on the cloth contained therein as is imposed on cotton cloth of the same description, weight and count of threads to the square inch; but such handkerchiefs or mufflers shall not pay less rate of duty than forty-five per centum ad valorem. If such handkerchiefs or mufflers are hemstitched, or imitation hemstitched, or revered, or have drawn threads, they shall pay a duty of ten per centum ad valorem in addition to the duty hereinbefore described, and in no case less than fifty-five per centum ad valorem; if such handkerchiefs or mufflers are embroidered or in any manner, whether with an initial letter, monogram, or otherwise, by hand or machinery, or are tamboured, appliqued or trimmed wholly or in part with lace or with tucking or insertion, they shall not pay a less rate of duty than sixty per centum ad valorem."

In the linen schedule, in the paragraph relating to laces, edgings, veilings, embroideries, tuckings, tamboured articles,

etc., the expression "composed of flax, jute, cotton or other vegetable fibre", was employed both in the old and the new tariff law. Under this heading, the duty under the Wilson law was 50 per cent., and under the present law it is 60 per cent. A determined effort is now being made in the United States to substitute domestic manufactures of laces, handkerchiefs and other similar cotton fabrics in place of foreign goods of those descriptions; and the promoters of these domestic industries have to contend not only with the antagonistic interests of the importers, but also with the prejudice of some American consumers in favor of foreign goods, and also with the undoubted tendency of American manufacturers toward the production of those staple goods in which economical processes are more important than artistic design or patent manipulation.

Embroidery is one of the oldest of the ornamental arts, and therefore nearly as old as that love of decoration which is so deeply rooted in human nature. The song of Deborah makes the mother of Sisera exclaim: "Have they not divided their prey? to Sisera, a prey of divers colors of needlework on both sides?" By "needlework on both sides", is understood a kind of embroidery by which both sides of the fabric were alike, and requiring so high a degree of skill and patience in its execution, that even at the present day only races pre-eminent for patience, like the Hindoo, Chinese and Japanese, practice this kind of work.

Even in the labor-saving weaving embroidery and finishing machinery of the present day, more patience is required than the temperament of the American manufacturer relishes, and the machinery itself is often constructed with a view to magnitude of production rather than to perfection of texture and finish. The same comment may be made respecting the woolen and worsted industry, and, in fact, most other branches of manufacture.

The imports of textile fabrics into the United States for the fiscal year ending June 30, 1896, included the following:

Total value of.	
Manufactures of wool	$48,400,000
Manufactures of cotton	32,300,000
Manufactures of silk	26,600,000
Manufactures of flax	14,200,000
Manufactures of jute, hemp, and other vegetable fibres	500,000
Total imports of textile fabrics	$122,000,000

of which about one-fourth consisted of manufactures of cotton.

Having thus analyzed the character of our imports of cotton goods and ascertained the proportion which they bear to other imports of textile fabrics, let us now see how our imports of manufactures of cotton compare with our exports. For the fiscal year ending June 30, 1897, the imports of all kinds of foreign cotton goods into the United States were valued at $34,000,000, while the exports of all kinds of domestic cotton goods from the United States during the same period were valued at but $21,000,000. And the total of exports of domestic cotton goods, in 1897, was exceptionally large, being nearly two-thirds as great as our imports of foreign cotton goods. In 1893 our imports of such goods were $33,300,000, while our exports were but $11,800,000, or but little more than one-third as great as our imports. In a general way, it is fair to state that our imports of foreign cotton goods in recent years have been twice as great as our exports of domestic cotton goods. Nevertheless, the subject of imports is less important than that of exports, because we hope and believe that henceforward the percentage of imports will diminish, while the value of our exports will increase.

While our exports of domestic cotton goods consist almost wholly of cloths, in which the percentage of labor to material is very low, our imports of foreign cotton goods as already stated, are mainly laces, edgings, embroideries, handkerchiefs, knit goods, and other fabrics in which the percentage of labor to material is high.

With the general introduction of machinery in the modern manufacture of laces, embroideries, edgings and other fabrics in

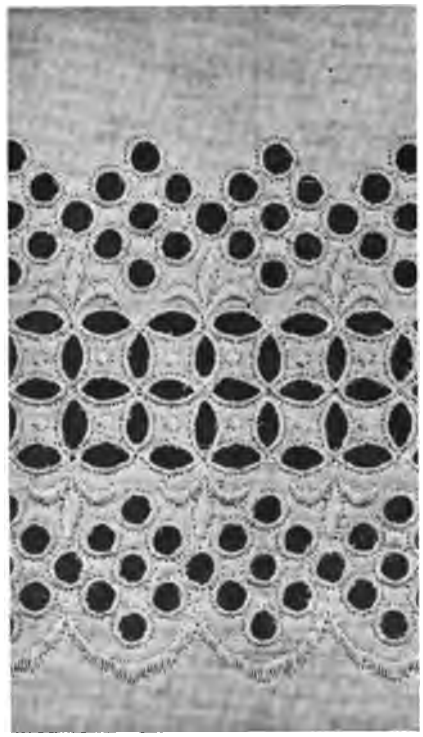


FIG. I — SWISS LACE.

FIG. 2 — SWISS LACE.

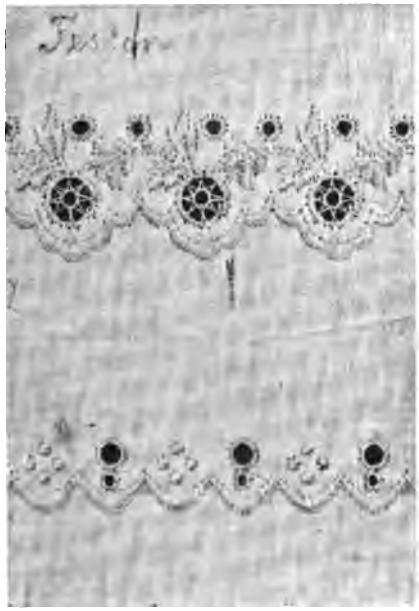


FIG. 3—SWISS LACE.

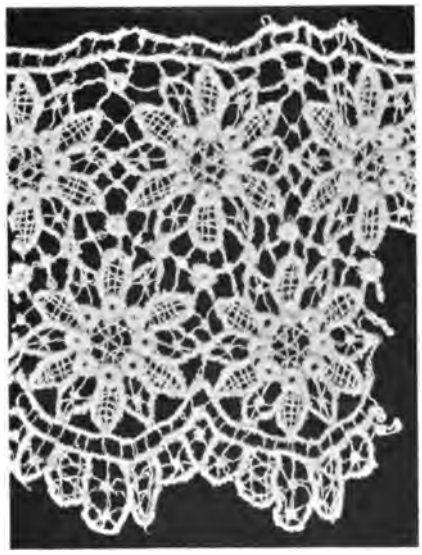


FIG. 4—SWISS LACE.

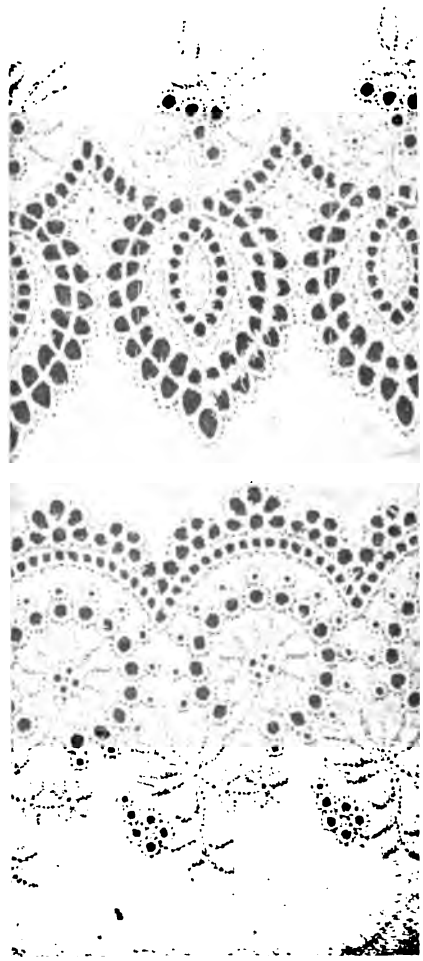


FIG. 5 — SWISS LACE.

which the hand implement employed was the needle rather than the shuttle, the opportunity for this class of manufactures in the United States improves.

The adaptation of labor-saving machinery to the producton of the highest grades of ornamental needlework is especially appropriate in America, because our women are foremost in devoting to the garniture of their minds the time which their ancestors were compelled to expend in spinning, weaving, sewing and embroidery. The Greek ladies were greatly given to embroidery, as were the ladies of the Middle Ages, because they had nothing else to do.

In the time of ADDISON the discontinuance of needlework as the supreme feminine amusement is thus mentioned in a letter to the *Spectator:*

"*Mr. Spectator:* I have a couple of nieces under my direction, who so often run gadding abroad, that I don't know where to have them. Their dress, their tea, and their visits take up all their time, and they go to bed as tired with doing nothing, as I am after quilting a whole under-petticoat. The only time they are not idle is while they read your *Spectator*, which, being dedicated to the interests of virtue, I desire you to recommend the long neglected art of needlework. Those hours, which in this age are thrown away in dress, play, visits, and the like, were employed, in my time, in writing out receipts, or working beds, chairs, and hangings, for the family. For my part, I have plyed my needle these fifty years, and by my good will would never have it out of my hand. It grieves my heart to see a couple of proud, idle flirts sipping their tea, for a whole afternoon, in a room hung round with the industry of their great-grandmother. Pray, sir, take the laudable mystery of embroidery into your serious consideration, and as you have a great deal of the virtue of the last age in you, continue your endeavors to reform the present. I am, etc."

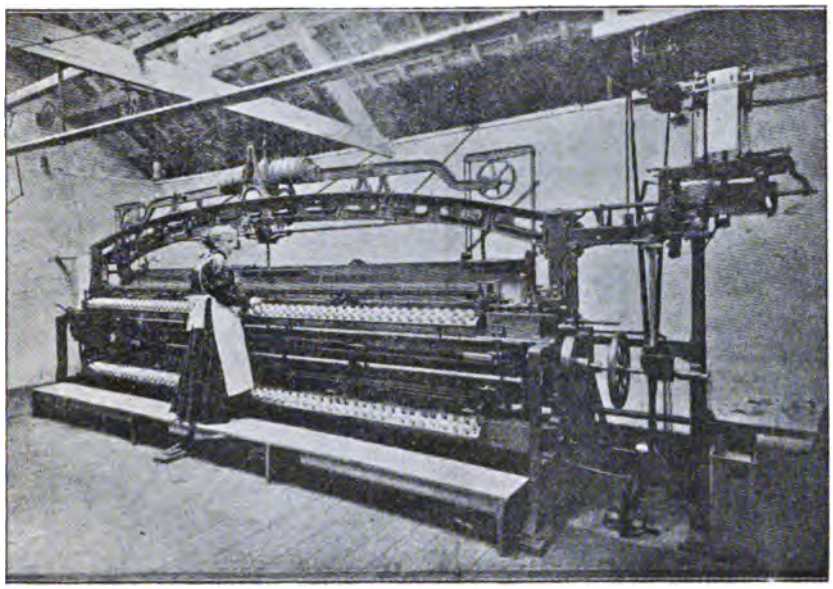
Nearly all of the laces and embroideries now used in the United States are machine made, and the humblest girl in America goes into the local dry goods store today and buys an embroidered apron for 25 cents, made perhaps in Philadelphia, or Camden, N. J., which, though coarse in texture, is ornamented

to a degree which would have delighted the heart of the *Spectator* writer whom I have quoted, and which was then only within the reach of the rich. When embroidering and lace-making machines first began to be introduced, the fact that they were resisted by the hand-workers of the north of Ireland, is probably one of the reasons why almost the entire industry went over to St. Gall, Switzerland, and elsewhere on the Continent. But, as in the case of Norwich, England, which lost the textile industry to Lancashire because of its antagonism to the power loom and spinning jenny, but is now more prosperous than ever, because of the establishment of new industries, so the hand workers of the north of Ireland seem not to have suffered poverty and distress through the transfer of their occupation to the machine operators of Switzerland. They have found other employment, as will some of the machine workers of the Swiss republic, if the time comes that these imports of manufactures of cotton goods into the United States cease.

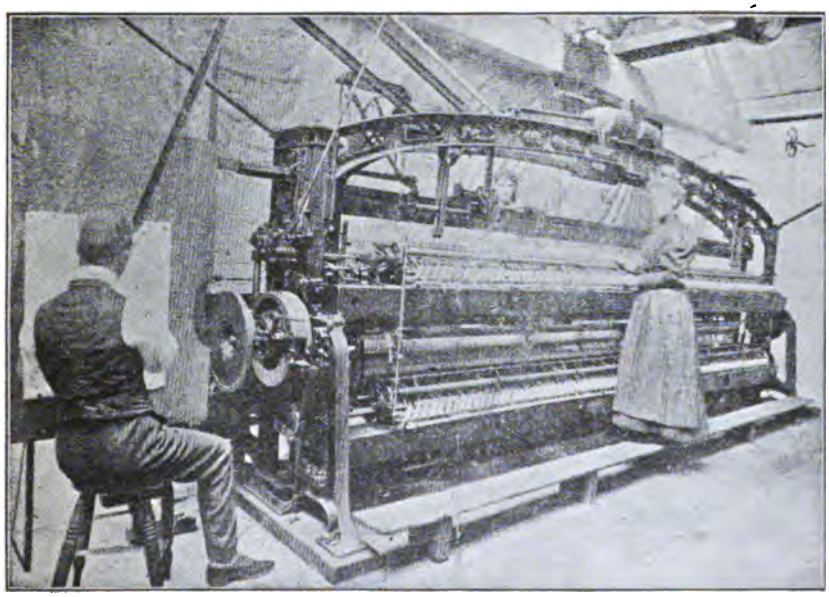
One of my European correspondents writes me this very week that the inventor of the machines which were most recently introduced to turn off embroidered handkerchiefs complete, is said to have offered them to big lace makers in Nottingham, but was told to take them away, as they would turn out or stop all the machines in Nottingham's shops. He took them to St. Gall and Plauen, where he sold them. Today the Nottingham people, those who want to be in the trade at all, have had to open houses in Plauen and St. Gall and to use

THE MACHINES THEY REFUSED.

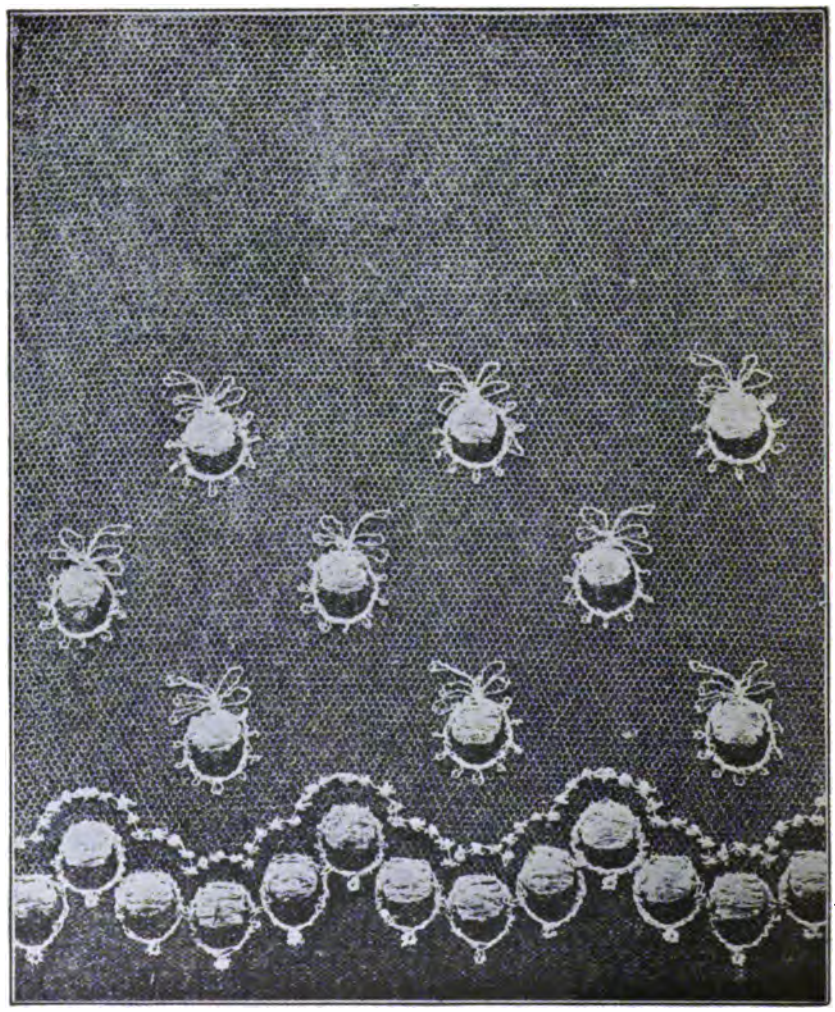
In 1829, one HEILMAN invented an embroidering machine, which, to date, is the groundwork of all others, although, like JACQUARD and his loom, I doubt if HEILMAN would recognize his own work in the modern machines. The machine has 200 to 400 needles, and works the patterns by means of a stork's nose or pentagraph arrangement. HEILMAN'S machines went up all over the world, but for ten years they were unsuccessful. One F. E. RITTMEYER worked on them till their product was pro-



PATENT JACQUARD MACHINE.
The Jacquard producing the Pattern and dispensing with the Pantagrapher.



PANTAGRAPH MACHINE AT PRESENT IN USE.
The Pantagrapher at work producing the Pattern.



PATTERN OF TEARDROP LACE MADE ON THE PATENT JACQUARD EMBROIDERY MACHINE.

nounced good enough to "go". It was encouragement from the United States that caused the Swiss to go on trying till the machines turned off edgings and insertions such as satisfied New York, Boston, Baltimore and Philadelphia, the big buyers of those days. In 1842, SAMUEL DRAPER, in Nottingham, harnessed a bobbinet machine and jacquard loom together and got out a machine-made lace that pleased and surprised. MALHERE, a Frenchman, tied the jacquard to the bobbin or cushion lace machine and revolutionized lace-making machines. JACQUARD is justly entitled to the gratitude of almost all workers in textiles, for he taught them to go on and on adding to all in their possession.

HANDKERCHIEFS.

Handkerchiefs, except the very finest all-lace ones are woven. The very fine linen and muslin are woven on ordinary and on jacquard looms. To get anything like a good idea of how important these industries are to Annaberg, Plauen and St. Gall, one has to go over the export statements for a period of years. St. Gall sent us, in

	1895.	1896.
Cotton embroideries worth	$4,222,611	$3,633,988
Cotton cloth, plain and printed	142,492	133,045
Embroidered curtains	1,411,575	1,142,377
Handkerchiefs and a few other fancy articles,	1,217,883	1,220,438
Laces, silk and cotton	127,889	91,877
Out of a total of	$7,306,644	$6,504,078

In the first six months of 1896, Switzerland sent out $13,020,117 worth of cotton machine-made embroideries, and silks worth $20,415,575.

In 1894, Switzerland took from us goods worth $7,016,855, and sent us $14,368,066. In 1896 she took $7,765,663 and sent $18,194,966. Switzerland sent us in 1895, $7,566,394 of cotton machine-made embroideries. In the same time England took $3,803,207, Germany $3,601,331, France $1,080,521,

Austria $1,608,756, Italy $907,427, and Belgium $288,842. The total amount of these articles exported was $25,072,766. Of silk goods she sent the United States $5,443,920, to England $11,842,364.

WAGES.

The wages paid in Annaberg, Plauen and St. Gall are, as are the wages all over the old world, about as low down as competition can carry them. Stitchers in St. Gall, on regular white goods, get weekly $3 to $4; stitchers in St. Gall, on fancy goods get weekly $7 to $8; girls attending machines get weekly $2 to $2.80; foremen get weekly $6 to $10; girls who mend get weekly $2.40 to $2.80; girls who make up the goods, pack, etc., get weekly $1.50 to $2.40. Girls in cotton mills 30 to 50 cents per day, men get 60 to 70 cents. Cotton weavers, males, 60 cents; females, 40 cents. The average pay of mill operatives in Germany is $3.74 for 60 hours, or an average of 10 hours daily. The shuttle lace-making machine, of which I have cuts and samples of work, is the newest thing in the line and does excellent work. It will work silk as well as cotton and on any kind of fabric fit for embroidery. The piercing apparatus is easily arranged and controlled. It has an exquisitely fine thread tightener, and an expert workman can make 100 to 120 stitches per minute. These machines are run by power and require one-fourth to one-third of one horse. The machines are 26 feet long, 6 feet, 6 inches wide, and 10 feet, 5 inches high. They are built in two repeating sizes, viz., 6-4 and 4-4, French. Length of embroidery is 14 feet, 7½ inches. One machine with 6-4 repeating weighs 3 tons, 2 quarters, 5¼ pounds. A 4-4 repeating weighs, unpacked, 3 tons 2 hundred weight, 2 quarters. It takes 10 to 14 days to put up these machines, if the fitter from the factory does it. It is always wise to have him, as others will botch the work.

At the base of these businesses are the Annaberg, Plauen and St. Gall schools. These schools are almost as much governmental institutions as are the common or Volkschule. The one

at Annaberg takes only 15 scholars, though in time it is to take more. It has one lady teacher and an inspector. The latter is corresponding secretary. The school costs the government 7,000 marks, about $17,000. The girls are paid one mark a day, while learning, and earn 50 to 65 cents a day after graduation. The State furnishes all the designs, patterns, cards, etc. Each girl is taught every variety of lace making; there is no fixed term; each scholar stays till she has learned all that is to be taught.

The real purpose of the school is to keep up the higher class of work, *i. e.*, ideal lace making. The work turned off in the town and mountain shops is much inferior; in fact, it is coarse and common, but lace makers trained in the schools to make the very finest of lace, find it easy to give only good results, the very best finish to shop-made laces. The common goods get a touch and a finish that merely factory trained girls could never give them. Herein lies the real reason for the school's right to be. The laces made in the school are sold at prices based on the time it would take an expert lace maker to turn them off. What is true of Annaberg is just as true of Plauen and St. Gall. The schools of these cities are models of their kind.

METHODS OF MANUFACTURE.

The methods of manufacturing laces, edgings, passamenterie, etc., are so similar in Plauen, St. Gall and Annaberg, that a word about one will cover the others. House lace making and mill lace making are to be found in each city. In old times hand work was the rule. Even now the nicest laces and effects are hand wrought. A time came when American markets demanded so many that machines were invented to supply them. In the forties, baptismal garments, handkerchiefs, collars, cuffs, barbes, bows, undersleeves, caps, aprons, etc., were still made by hand. During these years mechanics made every effort to produce a lace-making machine. In 1850 these efforts succeeded. After the war of 1861 to 1865 in the United States

was over, a period of prosperity began for Annaberg, Plauen and St. Gall, that has transformed those cities from villages, with homes little better than huts and hovels, to large cities with residences of palatial proportions.

INCREASING COMPETITION.

Many of the goods were at first made in large factories. In time, wages went down too low to be borne. Men left their looms and machines idle; bought, with their little savings, a machine or two for themselves, and began making in the hills, mountains and valleys. Successful at first, they too, today, have to suffer for their folly by the pressing down of prices due to an ever-increasing competition. The work of men and women and children, in the homes, is so much a part of the life of these hill people, the lightness and square inch value of the products so great, that I question the possibility, certainly the wisdom, of eradicating the house industry, by mills or machines run on factory principles. All these articles, handkerchiefs, edgings, passamentarie, etc., are made, as a rule, by one party and finished by another. The Pullmans, Irish people, from Belfast, who have a house in St. Gall, have particular, if not patented, secret methods of finishing.

I have obtained several foreign catalogues with lace machinery cuts which I should like to introduce if time permitted. I have also obtained a large photograph, 1 x 2 feet, of what is said to be the largest lace curtain machine in the world. The photograph was taken abroad, but the machine will be set up at Patchogue, L. I.

Many of the New York merchants insist that there is absolutely no important work going on in this country in the manufacture of cotton yard laces, and only a little in cotton handkerchiefs. The lace curtain industry, however, has grown to a great magnitude.

The photograph of the machine which is just being introduced at Patchogue, L. I., shows a curtain machine with six widths of one pattern in process of manufacture. A cynical

New York opinion relative to the subject of laces, handkerchiefs, embroideries, tamboured Swisses and nets, is to the effect that the incentive of a high tariff and a large market has prevailed steadily the last two years, and several attempts have been made to manufacture these goods, but without success.

Some few lace and embroidery machines have been brought over and worked, but not profitably. The labor for handling the machinery and finishing the product had to be imported and at a price which made it impossible to compete with goods from the other side, despite the fact of an added duty. The entire failure of the several projects hinged wholly upon the question of capable labor and the price of the same. Lace and embroidery making and finishing seem to be inborn in the labor located at or near the foreign lace and embroidery centres. This has been their daily environment, and the art has been naturally transmitted from father to son, and so on.

The same cynical New York authority whom I have interviewed asserts that the pay these people receive would not give an American laborer the bare necessaries of life. The American laborer could be educated up to the use of the lace machines, and the finishing of the product, just as they have been in lace curtain manufacturing, for now nine-tenths of the labor is American in the curtain plants.

It would take years of unprofitable education to perfect them, as the work is more difficult in turning out fine cotton yard laces and embroideries. One importer told me that while the instruction would be going on here, the foreign manufacturers would be preparing themselves for a cut in their prices, as the American continent is their main market. This possibility is thoroughly apparent when you consider that, owing to competition amongst themselves, they have already caused a vast lowering of price; for example: a large importer announced that a lace which he formerly sold at $4 per dozen yards, he is now selling at $1.15 per dozen yards, and he is making as much profit, considering the increased sales due to decreased price. If they could accomplish this on account of internal competition,

what would they not resort to, were they to see the prospect of the main market being lost to them on account of domestic manufacturers?

In the manufacture of cotton handkerchiefs, the same importers and jobbers in New York, claim that while some successful work has been accomplished, it is in the cheapest grades only. In the finer grades of cotton handkerchiefs, the same question confronts the domestic manufacturer, that of high price of labor, in comparison with the price paid in the foreign market, duty considered.

With tamboured Swisses and tamboured bobbinets, a different situation presents itself. These are domestic organdies and imported English bobbinets upon which the design is stamped, then followed with a heavy cotton stitching by means of what is known as the Bonnaz machine.

Successful work is going on daily and the domestic output is increasing. Goods have been turned out here which in quality thoroughly equals the foreign production, and the price of which is considerably lower than the goods imported under the present high tariff.

The labor on these goods is nine-tenths foreign, consisting mainly of girls brought over from the lace ond embroidery centres of Switzerland. These skillfully work the Bonnaz machine, while men do the finishing and bleaching of the brown product, when the organdie or Swiss is tamboured. The bobbinets are imported already finished and are simply stamped and embroidered.

A false notion has prevailed all along that curtains could not be successfully finished in this country. The first attempts were, in a part, failures, but this was only due to the fact that the first operatives brought over were not of the best order. The finish today is as good as any produced in Europe, and there is absolutely no truth in the prevailing idea that the water in this country is not fit for finishing properly. The skilled finisher knows just how much washing to give the yarn in its natural state to produce the desired ecru color.

In the domestic manufacture of what are known as "Nottingham lace curtains" a considerable forward step has been taken recently in the opening of goods for next spring, so much so as to astonish the importers, and the claim is made that many of the latter are to abandon foreign goods and handle the product of domestic mills. I would like to enter more thoroughly into an analysis of the reasons why certain other classes of cotton fabrics are now imported, but what has been said respecting laces will apply in a measure to all others.

In conclusion, I have selected a few figures at random to show the annual imports of foreign cotton goods at various periods for seventy-five years past.

IMPORTS OF COTTON GOODS.

1821	$7,589,711
1825	12,509,516
1830	7,862,326
1835	15,367,585
1840	6,504,484
1845	13,360,729
1850	19,681,612
1855	15,742,923
1860	9,079,676
1865	7,324,438
1870	21,900,898
1875	24,199,793
1880	29,929,366
1885	28,152,001
1888	28,917,660

Of course the domestic manufacture of these cotton fabrics would cause an immediate increase in our home market for cotton yarns, as well as in the labor of manufacturing, and it is no more improbable that the United States should surpass the Swiss and Germans in the manufacture of laces and embroideries than in the production of watches, in which America now easily leads the world.

Mr. EDWARD ATKINSON. I may now be permitted to occupy two or three minutes upon the subject of exports, as it appears to be the one to which our main attention is being given, to which your attention will be more fully called when you go through the Museum. As the older members will recall, it was a subject which I brought before you more than twenty years ago, especially in connection with cotton fabrics, when several of the factories which were represented in my own office were kept in operation by sending several thousand packages of our best, medium and fine goods to England, and selling them, without any loss, in the Manchester market. I have always been of the opinion that if our southern friends would today give some attention to forcing upon the British consumer a knowledge of the merit of a pure cotton fabric or rather open texture as compared to the finished fabrics of very smooth and close texture but heavily weighted, which are in common use even in England, large quantities of our southern domestics might be sold even in Great Britain itself. But I do not wish to join in the theory that we are to thrive by breaking down or taking away the British cotton manufacture. It is as important to our western farmers that all branches of industry should thrive in Old England as that they should thrive in New England. Great Britain buys of the western farmer one-half or more of the entire export of his surplus. Anything that impairs the purchasing power of Great Britain falls back with loss upon the western farmer, and when the western farmer does not thrive our home manufactures are depressed. I think this idea has unconsciously pervaded Mr. SEARCH'S speech. It has cropped out in many discussions of the competition of the South with New England. It is held that we may thrive by taking away from Great Britain a part of her work, and that the South may thrive by taking away from New England a part of the work that has been established there. I look upon this as a very false and wrong theory. What we have to do is to develop the wider market without displacing any of the goods now made in

other sections. The world is waiting for increased abundance. How shall we promote greater purchasing power in Asia, Africa and South America and among the non-machine-using nations? That is the problem to which I will presently call your attention. First consider one fact.

The people of the United States number less than 5 per cent. of the population of the globe, yet we consume between 33 and 40 per cent. of the commercial product of iron and steel of the whole world, 28 per cent. of the commercial product of cotton, about 25 per cent. of the world's entire commercial product of wool, and nearly 25 per cent. of the sugar. These facts indicate the consuming power of this nation and from its consuming power you may deduce its power of production, its power of supplying the other nations of the world with all its products with few exceptions, because these products are made under such favorable conditions that at the highest rates of wages that the world knows we yet make our great general national product at the lowest cost of labor by the unit of product. About 90 per cent. of our entire national product, or even more, is in its own nature absolutely free from any foreign competition of any kind and that rule applies to the 360 varieties of manufactured goods which are listed in the census, almost as fully as it applies to the product of the field, the forest, and the mine. Such being the conditions, how are we to promote exports?

We have the cheapest labor in the world. In evidence of which fact we are today exporting more than a billion dollars' worth a year of nearly every product that is made in the United States, crude or manufactured. Look over the manifests of the ships as they leave New York. You will find some article of nearly every fabric that is made about to be carried to every part of the world. There is not one of these fabrics from the crudest products of the field, the forest or the mine up to the finest watch or the highest type of metallurgy in which the wages that are recovered from the sales of these exports are not from 25 to 100 per cent. higher than they are in the manufacturing countries with which we compete—Great Britain, France,

Germany and the low countries — and 50 to 1,000 per cent. higher than they are in the countries to which a large part of these goods are exported and sold. It therefore follows as a matter of necessary inference, that if the rate of wages governed the cost of production and established the cost of labor by the unit of product, we could not expect a dollar's worth of anything that is produced within our own limits. That is the rule of progress. Through the application of science and invention to the useful arts, the cost of labor by the unit of product is diminished, while the wages of the workman are augmented.

Again, the rate of taxation per capita in this country for national purposes is less than half that of Great Britain, while that of Great Britain is less than that of almost any European country. The advantages of position in soil and climate, in effectiveness of labor, in versatility, and other factors too numerous to mention, are so manifestly in our favor that at the highest rates of wages we produce almost every fabric that is worth making and that the world needs, at the lowest cost measured by the unit of labor. What we do not produce at the lowest cost by the unit of labor are the crude products and the hand-made fabrics, of which the exports from the non-machine-using countries of the world — Asia, Africa, South America, Australia and the like—mainly consist. Of this you will find evidence in this wonderful commercial museum.

Now let us give regard to our customers. The most hearty approval may be given to every effort to promote the export of our goods to South America and to the Latin-American countries. How are we to secure this end? Not many years since I made a trip from London to Manchester with a German merchant. Finding that I was interested in the cotton manufacture, he said, "I have just put an order in the United States for a thousand bales of drills to go to South America. I am now on my way to Manchester to buy four thousand bales more. I would prefer to send wholly American drills." I asked, "Why do you not?" To which he replied, "I have a fair amount of cash capital in my business on which my credit is sustained.

That cash I can invest in American drills up to a certain point, but when it comes to the use of my credit I must go to Manchester to buy my four thousand additional bales. To the bill of these goods I attach my bill of lading. My London banker accepts my bills at four months, with an extension of four months more if I need it. The goods are then suitably packed to be carried into the mountains and into the heart of South America, where they are virtually bartered for everything that the South American has to sell. All these goods I can bring back to London in time to sell them and meet my bills. In the United States I must pay cash; I cannot pay in goods; I cannot secure a long credit." I asked him how much his guarantee account was worth on this trade with South America. To my surprise he said, "Less than one per cent".

Now let us turn again to the question of purchasing power. For many years Great Britain has bought from us 50 per cent. of all our exports. This year, owing to the bad harvest in Europe, we shall send our flour from this country at the rate of a barrel of flour a year for the whole population of Great Britain, and that is the average consumption per capita in this country. It will not all go to Great Britain because they still make a small part of their flour for their own consumption. The British Colonies only, take 10 per cent. of our entire exports. France, Germany, Belgium and Holland take 23 per cent., the two latter countries mainly passing the goods through to other parts of Europe. These portions summed up make 83 per cent. of our entire export. To the rest of the world we sell only 17 per cent. It is in that direction that we must look for an increase of purchasing power. You will observe that the purchasing power of nations is in ratio to their application of science and invention to their own products. Machine-using nations recover higher wages from their products than prevail in any other part of the world, and by the lessened cost of their production are enabled to export their goods. From this export they derive the power to buy from us the food, the fibres and the metals which they must have to sustain their industry and which we

produce in excess. We are the only manufacturing nation producing an excess of food, fuel, timber and metal. All our competitors are greatly deficient in one or more of these essentials in the manufacturing industry. South America, Mexico and all the Latin-American countries combined, buy of us less than 9 per cent., or less than the British Colonies only, while Asia, Africa and the rest of the world take the other 8 per cent.

How shall we increase the purchasing power of this vast proportion of the population of the globe? Is there any other way than by buying of them in exchange the crude or partially manufactured materials, which while not absolutely necessary to us in the processes of our domestic industry would, if free from taxation, yet enable us to extend our manufactures at high wages and low cost, thus developing our exports not by taking away from our best customers any part of their work, but by developing a greater purchasing power among the races of the world that are still so far behind in the progress of industry?

Mr. SEARCH has estimated the quantity of cotton goods exported from Great Britain to India, at about $72,000,000 worth. That would be less than 30 cents' worth per head of the population of India. He also estimates the exports of China at $42,000,000. That would be less than 10 cents per head of the population of China. If similar computations are made of the exports of cotton goods to all parts of the world, it will at once become apparent how wretched and meagre is the supply. The people of China, computed at about 450,000,000, are a cotton clad people, in the colder parts of China wearing thick wadded cotton garments. We have touched but the fringe of China. Nearly the whole population is clad in hand-spun and hand-woven fabrics. Suppose they could apply their hand-work to something that we want, exchanging the ten days' hand-work at ten cents a day for a dollar's worth of weaving in our southern factories. Would not that be a good bargain for both? The world has become a great neighborhood. The law of commerce by which it lives and moves and has its being among men and nations is that of mutual benefit. The measure by which we

can serve other nations is not the measure of the work that we do at high wages and low cost, but what we can save them from doing, in yielding greater abundance to them by our manufactures in exchange for their crude and partly manufactured products, which we can convert into their higher forms. When the principle is fully comprehended that high rates of wages in money or what money will buy are the compliment, or perhaps I should say, the derivative of a low cost of production, much contention will be saved, and the principle of commerce, that is, the rule of action which governs human beings, that they exchange products and services for mutual benefit, will be permitted to have its free way. We shall then realize the true method of protection to domestic industry.

PROGRESS IN COTTON MANUFACTURING IN RUSSIA.

VLADIMIR P. POLEVOY, of the Great Yaroslavskaia Cotton Mill, Russia, New York City.

The Russian cotton manufacturing of the present time reached the stage of development when, not satisfied with almost complete exclusion of foreign fabrics from the immense interior market, it increases each year the export of home fabrics to other countries. Like in any other branch of Russian industries the progress was made by gigantic strides and not gradually. The man who visited Russia ten years ago will be unable to recognize the Russia of today. America is the only country in the world which could be compared with Russia in regard to rapid progress in the manufacture of textile goods. We manufacture print cloths which could vie with the finest French fabrics, our silk stuffs are equal to those of Italy, our velvets are equal to the best products of Lyons, our woolen goods are inferior to none in the world. This may seem strange to people whose ideas of Russia are limited to a vast plain peopled by semi-civilized barbarians.

Even as far back as the middle of the eighteenth century, the manufacture of cotton cloth was carried on very largely from yarns imported from England. This manufacture was specially developed in the provinces of Moscow and Vladimir. But from the beginning of this century, owing to the rapidly increasing demand for cotton yarns, spinning mills sprung up one after another in rapid succession. Yet up to 1842, when the bill for-

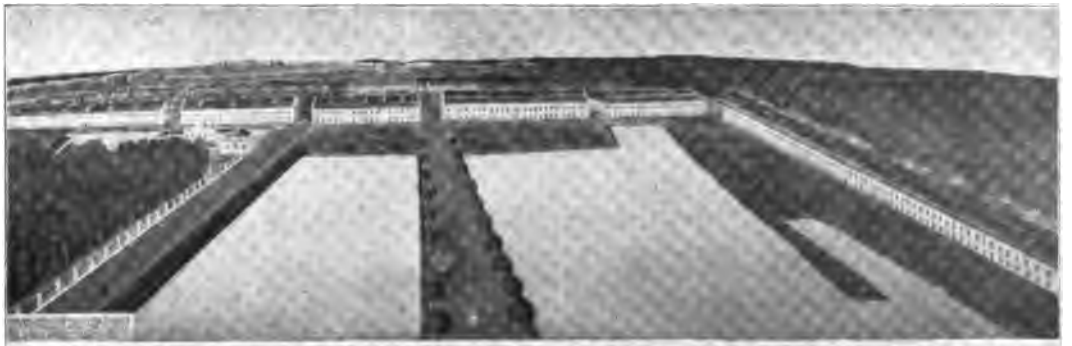
bidding the export of textile machinery was rescinded by the English government, the Russian manufacturers had a hard time fighting the difficulties connected with the equipment of their mills with the necessary machinery, and therefore the cotton spinning industry at that time could not be considered to have been put on a firm commercial ground. Yet even a superficial review of the history of development of cotton manufacturing in Russia will show the wonderful rapidity of same during the last 50 years. In 1843 there were in Russia only 350,000 spindles, producing 36 English pounds of yarn per spindle per year, while at the present time there are 6,000,000 spindles with almost a double amount of yarn per spindle per year.

Alongside with the growth in the number of new and more improved—as to the equipment and management—cotton mills, both spinning and weaving, there is noticeable (1) the enlargement of the existing mills in the way of increasing the number of working machines, the number of spindles and looms, with the replacement of old by new improved machinery; (2) the increase of the production, notwithstanding the variety of products; (3) the equipment of weaving, cloth printing and finishing mills with machines of Russian make; (4) the more and more increasing consumption of native grown cotton; (5) the replacement of foreign by Russian technical staffs; (6) the care taken by the mill owners about the improvement of the condition of their workmen as regards the hygienic and sanitary matters and the elevation of moral and mental standard of their workmen; and (7) as said in the beginning, owing to the improved quality, the Russian cotton products are steadily crowding out with great success the foreign fabrics from the vast interior market, and the export of home made fabrics to other countries is noticeably increasing, satisfying not only the substantial demands of the majority of the consumers, but often the most fastidious tastes of the fashion.

The progress in the construction of the mills is noticeable in the enlargement of the side openings for the light and in the introduction of weave sheds; in the introduction of electric

light; in the improvement of the sanitary and hygienic conditions by introducing humidifiers and ventilators; only one thing as yet could not be done away with, and this is the noise produced by the machinery; and at last in the introduction of means for prevention and extinguishing fires (Grinnell's sprinklers) which is carried on to a large extent, being at the same time a means for the reduction of the insurance rate. The illustration of the Great Jaroslavskaia Manufactura, the leading cotton mill in Russia, shows the striking difference in the appearance of a Russian cotton mill of today and that of 30 years ago.

Though the equipment of the weaving and finishing rooms of some of the mills is effected to some extent by the Russian concerns, the workshops of some of the largest mills are not satisfied by doing only the repair work, but commenced to turn out complete machines for their own use. In many manufacturing centres like St. Petersburg, Moscow, Ivanovo-Vosnesensk and Lodz, special machine shops for construction of looms, printing and finishing machinery have been started; yet, as to the spinning and power producing machines, Russia has to depend entirely upon foreigners, and chiefly upon England. The looms manufactured in Russia are such crude articles that really they could not be said to constitute a competition to the English looms. The English machine manufacturers, it may be said, have monopolized the Russian market for cotton machinery, notwithstanding the fact that their machines, such as looms, spinning machines, warpers, spoolers, slashers, are inferior in make and higher in price than those of American manufacture, and it is a pleasure for me to state here that the experts from Russia, who have visited quite a number of American machine shops and cotton mills, declared unanimously that American machinery is far superior to any other in the world, in the make, finish, quality of material and the ingenuity of construction. The most astounding fact stated by them is that in many instances the price of the superior American machines, delivered in Russia, is much lower than that of English machines, the excess of freight from here to England notwithstanding. I



ЯРОСЛАВСКАЯ БОЛЬШАЯ МАНУФАКТУРА ВРЕМЕНЪ ЗАТАЦЕВАГО.

ЯРОСЛАВСКАЯ БОЛЬШАЯ МАНУФАКТУРА ВЪ ЕЯ СОВРЕМЕННОМЪ ВИДѢ.

would most emphatically advise the builders of American cotton machinery to turn their eyes upon the Russian market, and try to replace, if not entirely at least in part, the English machinery there.

It will not be out of place here to relate of the gigantic English trust, which has been retarding and is still retarding the progress of Russian cotton industry. Up to a very recent time almost all Russian cotton mills have been in actual servitude in the hands of the English, who have, so to speak, formed a cotton mill trust. The originator of the trust was a German from Bremen, who started his business in 1840 with a small commission house, engaged in sale of small parties of cotton to Russian merchants; then a large Russian firm gave him a trial order for spinning machinery; then other firms followed their example. The activity of this German commenced in 1842, when the export of machinery was allowed from England. The English machinery was usually accompanied by English engineers, workmen, etc., who were sent over to "teach the Russians". Little by little the small business of the German developed into a large firm which, in the absence of competition, became very important and independent. While furnishing cotton machinery the firm did not lose sight of cotton, and soon monopolized that branch of the trade. When mills were equipped with English machines and Englishmen were put in charge of them and were running the mill, the cotton bought through the same firm always was found to be satisfactory by the hirelings of the firm.

Gradually the firm became the only furnisher of American cotton for Russian mills. In 1850 it was an established fact that the prices of cotton for Russian markets were fixed by the firm, and during the cotton crisis in the sixties, the same firm, being sole importer of cotton, dealt it out to different mills at its discretion, sometimes as a matter of favor. The firm understood very well that it had the upper hand of the manufacturers and became very overbearing and despotic. No new mill could be started without its interference, for it made contracts with almost all English machine firms, in virtue of which it became sole

representative of them in Russia. When a man wanted to start a mill he had to go to the head of the firm with an humble request to help him out with the equipment. The only question that was ever put by the manager of the firm was, "what kind of goods the man wanted to manufacture?" No details were allowed to be suggested, and if some bold man would venture to make a suggestion, he was promptly turned down with a sharp remark that "we know what is the best for you". If the man protested he was shown the door, and his prospect of starting a mill would then vanish forever. All materials for the erection of a mill were ordered from England, even such cumbrous things as pillars and iron beams for the building, which could easily be furnished by Russian firms, were ordered from England.

All the machines were (as they are even now) from the firms of Platt Brothers, Asa Lees, Howard & Bullough and Hetherington. No German, French, Belgian or American machines were allowed to be furnished to mills. As an invariable rule, the contract of the firm with the mills would contain the condition of payment to be made partly in stock or shares of the mill. This would virtually put the mill under the control of the firm. The firm, whose original founder is dead now, uses the same tactics and methods as yet, its motto being "protection and introduction of English machinery". Such a state of things produced a most preposterous assertion that mills could be run by the English only, while at the present time, where the English are dispensed with, the mill shows larger dividends, is better managed, free from strikes, and better and cheaper machinery is introduced into it from America or Germany.

In almost all our mills there is a tendency to introduce machines which would reduce the number of workmen and make the work of an individual workman easier. The picker and mixing rooms are furnished with the latest automatic feeders, sorting grates, pneumatic cotton elevators and the exhaust openers, which, besides the improvement in the hygienic conditions of the workmen, through the removal of the dust, lessen

the work. The revolving flat cards of English make are introduced more and more and the railway heads are consequently dispensed with. The combing machines are also widely introduced in our mills. The metallic drawing rolls found their application in Russian mills, and quite a number of them have been imported from America. As regards the ring spinning frames, up to a very recent time such frames have been used only for warp yarns, but lately ring frames are speedily replacing the mules in spinning filling yarn. This system of spinning evidently found favor in the eyes of Russian manufacturers and now we see some mills equipped exclusively by ring frames for the final spinning of both warp and filling yarns. In the weaving business the wide application of Jacquards and dobbies is noticeable, and it is a question of but a short time when the celebrated Northrop loom will find its way to the Russian cotton mills.

The application of accident preventing devices to different spinning and weaving machines is an accomplished fact in almost all the mills in Russia, and absence of such devices appears now as an anachronism. As regards the efforts of the mill owners in the direction of improvement of life conditions and sanitary surroundings of their workmen, it must be said that these efforts were not limited to the improvement of the interior of the mills, but were extended to the living quarters of the work people in the way of constructing model houses in accordance with the latest hygienic principles as regards the size, light, ventilation and other conveniences for the families of the workmen.

It will not be out of place to say a few words regarding the relation between the employer and the workmen in Russian mills. Here in America the help is hired by week, day or piece work. At the end of the week the operative draws his wages, and if the work is slack he may be laid off for an indefinite period; and the operative in his turn may give notice to the employer regarding his intention to leave and find employment elsewhere. Here the liability of the employer is limited to the wages paid to the workman. The employer has nothing to do

with the outside life of his workmen, where he lives, how he lives, whether he has a church to go to or a hospital to be treated in when needed. Each workman has his own doctor and pays for the professional services of same out of his own pocket. An entirely different state of things is found in Russia. It is true that the wages of a Russian workman are twice or three times lower than the wages of an American workman, and twice as low as that of an English workman, but in Russia the employer is compelled to hire his help only twice a year, and not by day or week, but for a period of six months. This usually takes place after the Easter holidays and in the fall. At that time he is also free to discharge his help if he so desires. Outside of his pay (which is calculated per day and in some cases per month, and sometimes, in rare cases though by piece work) the workman is provided, free of charge, with lodging (for families separate rooms are given, or if no quarters are provided by the employer, rent money is allowed in lieu of rooms), fuel, water and light. When a workman is sick he is treated at the mill's hospital free of charge, medical help being afforded gratis also to the families of work people. Care is taken of the children whose fathers and mothers are at work in the mill, for which purposes there are established free children refuges and for infants, cradle rooms: Each mill has a school for the children, all the expenses of which are borne by the mill owners. Nay, the mill owner is expected to provide for the spiritual needs of his workmen, so that mills have to keep a church or two, or even three, as is the case with the Great Jaroslavskaia Manufactura.

I must mention the fact that the mill owners have elicited a highly laudable spirit in meeting the demands of the government by doing even more for the bettering of conditions of their workmen than was required of them. They build hospitals, schools, almshouses for the benefit of their workmen, and some of them, like the owners of Jaroslavskaia Manufactura, Messrs. KARSINKINES, went so far as to build a theatre for the enjoyment of their work people; and all this is done at the expense of the owners and entirely free to the workmen.

Notwithstanding the willingness of the mill owners to further the interests of their workmen, they are often handicapped by the burdensome requirements of the government, like, for instance, keeping a police force in the mill, which the Russian passport system makes imperative. Outside of this, the annoyance caused by the factory inspectors cannot be paralled to anything of this kind in Europe and America. Owing to the liberal ideas which prevail in Russia since the latter part of Alexander III.'s reign, the places like those of factory inspectors were filled by men with pronounced liberal ideas. And in Russia, owing to peculiar Russian conditions, men with such ideas regard the employers, if not as sworn enemies of the employed, yet as creatures fully devoid of any sympathy with the working classes, and therefore on every occasion rule everything in favor of the employee against the employer, so that a factory inspector in Russia, with a few exceptions, is regarded as a kind of nuisance.

It is highly creditable to the Russian government to take the part of the workman, but this is sometimes done to the detriment of the mill owners and stands in the way of introducing labor-saving machinery in the mills. Take, for instance, the Northrop loom. At the present time in our mills one weaver tends to only two looms. If you were to make one man look after four looms, which he could do with considerable less trouble and with profit to himself, he would turn around and demand double pay, and the government would back him up. If he were to look after eight looms, he would be sure to demand four times his pay, and so on.

The introduction of labor-saving devices in Russia was marked by terrible riots and bloodshed and destruction of property unparalled in any other country. This alone makes the government to stand constantly on the watch between the employers and the employees. When the power looms were introduced in the mill of Scheibler in Lodz, Russian Poland, the workmen, feeling that this meant the loss of work for one-half of their number, destroyed the mill, not leaving one stone upon another.

This is what makes the Russian mill owners shy of the immediate introduction of the Northrop loom, which has been tested in Russia and found to work satisfactorily. To this is coupled another circumstance which makes the Russian manufacturers not over zealous in the introduction of new inventions, viz., that at the present time, even with old looms and machines they get 20, 30, 50, and in some instances as high as 80 per cent. on the capital invested in the mills. The extremely high tariff on yarns and cotton goods makes it possible to get as high as 80 per cent. on capital invested and have the sales of manufactured yarns and cloths to be made for one, two or even three years ahead. I read in Russian papers that at Nijni Novgorod Fair yarns and calicoes have been sold up to May, 1899.

With the enlargement of the spinning and weaving mills their productiveness has also increased in consequence of the improvement in general construction of the mills, introduction of steam power machines and machine tools, and also in consequence of the increase of the speed of the machines. It may be surprising to hear that the average speed of looms in Russia is 230 picks per minute and in not a few of them the speed reaches the figure of 260 picks per minute. The replacement of naphtha as a fuel resulted in the decrease of cost of manufacturing yarns and cloth notwithstanding the increase of wages. The economical side of the progress expressed itself in the use of steam of high pressure, in the introduction of steam engines of triple and quadruple expansion and in the decrease of the harmful resistance in machine tools consequent to the improvement in their construction, the use of suitable materials in the parts of machines subject to friction, and generally in consequence of the investigation of the laws of friction and study of lubricating compounds made by the Russian engineers and also by the widely spread use of indicators and dynamo meters for controlling the motive power. In some cases electricity has been applied for transmission of power at a distance.

Regarding the technical personel of our mills, it is noticeable that at the present time not only the majority of our weavers are

Russian, but a steady replacement by the Russians of foreign colorists and spinners is taking place, and about one-third of all spinning mills are managed by Russian engineers; while as late as 1880 their number did not exceed fifteen. This is the result of the firm belief of our mill owners that the mills can be run safer and more profitably by the Russian than by the English managers, who, as I said before, in many cases have been put in their places by the trust without any consideration as to the ability to run a mill properly. It was found besides that the English foremen, overseers and managers were absolutely unfit to manage Russian workmen; it would be no exageration to say that nine-tenths of all the strikes in Russian mills were caused directly by the ungovernable temper and lack of consideration and forethought in English managers. It is a noticeable fact that whenever an English was replaced by a Russian manager, the mill would show from 5 to 10 per cent more dividends. We have now quite a number of skilful foremen from among workmen of spinning and weaving mills, to whom it would be quite safe to entrust the supervision of separate machines in different rooms. But the demand in this direction, at the present state of industry, is still increasing, and to meet this many mills have started day and evening schools with special courses for the purpose of preparing men with technical knowledge for different departments of cotton mills. By this it is expected to fill up that gap in the organization of our mill labor, which made itself felt for many years. As to the higher technical schools, which could supply engineers able to take care of cotton mills, we have several such schools in Moscow, St. Petersburg and Charkoff. Regular classes on textile subjects form a part of the program in these schools.

Turning to the statistical data, borrowing same from the official sources, we see that in 1892 there was in Russia 4,331,508 spindles and 100,634 looms. Comparing this with the number of spindles and looms in 1879, we see that the number of spindles increased by almost 25 per cent. and the number of looms by at least 20 per cent. At the present time the number of spindles

reaches approximately the figure of 5,000,000 and Rusia, by the vastness of technical means, occupies first place in Europe. Taking into consideration that in Russia quite a number of mills work both day and night (though lately there was a law promulgated forbidding night work by the workmen who work during the day, the law going into effect on January 1, 1898), when comparing the Russian cotton industry with same industry of other countries, it would be right to state that our spinning mills have at their disposal 6,5000,000 spindles and 200,000 looms, reducing the working time to the foreign working year of 3,000 hours (300 days of 10 hours each).

The amount of cotton consumed by Russian cotton factories is about 12,500,000 Russian poods (a pood is equal to 36 English pounds) or about one tenth of the whole amount of cotton used in Europe and America; the tendency to use native grown (in our Central Asia posessions) in preference to American grown cotton is still on the increase and at the present time one-quarter of the whole amount of cotton consumed by our mills is from Central Asia and from Caucasus. About 9,000,000 poods come to the share of foreign grown cotton, American, Egyptian, East Indian and Persian. Thanks to the care of the government in regard to the development and improvement of our Central Asian cotton plantations, the area of the latter increased during the last seven years (1887–1893) almost by 125 per cent. viz., from 61,000 desiatin (a desiatin equals 2.9 acres) to 136,000 desiatins.

The extreme variety in the fabrics calls for the same variety in the kind of cotton; in some cases short staple with rough fibre is used, like the Bokhara and native Caucasian (karagos) cotton; in other cases, for high numbers of yarns, for instance, Egyptian cotton of high grade is used and also Sea Island stands in demand by our mills for some special fabrics. As regards the medium staples (middling, good middling and middling fair) which are mostly used in cotton industry, we notice the consumption of American cotton on the level with the increasing demand for Central Asian cotton grown from American seed of

different kinds. The Great Yaroslavskaia Manufactura, which owns most of the Central Asian plantations, grows a peculiar kind of cotton of long staple, which was given the name of "wonder cotton", the length of the staple and its peculiar silkiness makes it impossible to match the same even with the best Sea Island cotton grown in America. The writer had tried very hard to obtain in this country something approaching to the "wonder cotton", but the best authorities on cotton unanimously declared that no such cotton could be obtained anywhere else.

Notwithstanding the increasing demand for the native grown cotton, the importation of foreign grown cotton also increases, which may be seen from the following table (with the average for each four years):

Year.	Amt. in 1,000 Poods.	Year.	Amt. in 1,000 Poods.	Year.	Amt. in 1,000 Poods.
1883,	8,090	1887,	10,056	1891,	7,131
1884,	6,277	1888,	6,890	1892,	9.466
1885,	6,378	1889,	8,620	1893,	7,444
1886,	7,248	1890,	7,995	1894,	11,260
Average,	6,998	Average,	8,390	Average,	8,825

The cotton brought from our possessions in Central Asia, such sorts as Bokhara, Samarkand, Tashkent and Caucasian, by the roughness and shortness of staple, generally speaking, represent the nearest approach to the East Indian cotton; but the Tashkent cotton grown from American seed differs very little from American grown cotton and for certain numbers of yarns is used in preference to the latter. The culture of cotton is more and more improving in Central Asia, but in order to put our native culture of cotton on a firm basis, so that this important factor of our spinning industry could develop, it is necessary to establish a commercial classification of cotton, taking as a basis for this not only the degree of cleaning, but also the quality of the fibre (length and strength), which is very important in the spinning, and the regular classification of cotton will lead to improvement in the management of cotton plantations and in the methods of culture of cotton.

Our cotton mills until lately manufactured almost exclusively low and medium numbers of yarns, not above 70; now, however, little by little the manufacturing of high numbers takes place up to Nos. 130–40 and, as an exception, we see Nos. 200 and even 310 spun on mules. The numbers most usually spun in our mills now are Nos. 30–40 for filling and Nos. 30–34 for warp, which are required for weaving ordinary calicoes. The yarns spun on ring spinning frames are limited to warps and mainly to medium numbers. At the present time, however, as I said, the use of ring spinning frames is extended not only to the warp but to the filling yarn as well, both low and high numbers; medium high from No. 70 and high from No. 100 to No. 140 and even as an exception up to No. 200.

Thread manufacturing also commenced to develop, promising in the near future to make it possible to wholly dispense with the necessity of importing thread from abroad. During 1885–1890 we received from abroad, on an average, of sewing and knitting thread about 140,000 poods each, while during the period from 1891–1894, the average annual import did not even reach the figure of 50,000 poods, in other words the import decreased 2.8 times. Till about three or four years ago the export of cotton goods from Russia did not amount to anything, but at the present time the export trade in such goods is assuming large proportions, mainly to Persia and China, and in some exceptional cases to South America.

In conclusion it would be appropriate to mention the peculiarity of the Russian cotton industry, which shows itself in the combination in one concern of not only spinning and weaving of yarns and cloth, but also of the cloth finishing processes; and in one case, viz., the Great Yaroslavskaia Manufactura, we see a combination in one firm manufacturers and cotton growers. This latter mill is considered at the present time the model cotton mill of Russia, which is undoubtedly due to the efforts of Messrs. KARSINKINES, the owners, who do not spare any means in order to bring the working of the mill to the highest state of perfection. This is also due to the selection of the manager,

professor of the Imperial Technical School in Moscow, S. A. FEDOROFF who is an expert in spinning and weaving machinery, both theoretically and practically, and a scientific man of high degree. He has written several treatises on spinning and weaving, in which he threw an entirely new light on the theory of working of different parts of spinning and weaving machines. The testing room of the Great Yaroslavskaia Manufactura, founded by Professor FEDOROFF, is one of the curiosities in Russia. The room contains all spinning and weaving machines and other preparatory cotton machines constructed on a small scale, just for tests, so that a small quantity of cotton may be turned into a piece of cloth, which, as is well known, cannot be done on machines of ordinary working size. This firm employs exclusively Russian engineers and was the first to introduce American textile machinery in Russia. In Central Asia it owns three-quarters of all cotton plantations, and their manager there, Mr. N. V. SKOBEYEFF, who has the nickname of Cotton King, is an unlimited ruler of the cotton market in Asia. The Yaroslavskaia Manufactura appears to be the only independent cotton mill in Russia, on one side not depending on foreigners for cotton, and in the matter of machinery buying same from whom it pleases.

Mr. EDWARD ATKINSON. I regret to say that my time was taken up in Russia by something more interesting than cotton mills, especially in Moscow the principal seat of the cotton manufacture. I also regret that I had not brought here some samples of Russian cotton fabrics, especially the printed cotton velvets, which are certainly very extraordinary specimens of

good work, notably in the printing and in the design. So far as competition is concerned, I do not think you need to give yourselves any uneasiness about the cotton manufacture. The wages in Russia are lower than in any other cotton manufacturing country except India. The cost of labor by the unit of product is so much higher that any export of cotton goods from Russia to other countries is out of the question. They have not yet learned the true secret of progress in effective work — high wages and lessening cost. Russia is an extremely protective country. The Russians are intending to compass as far as possible the manufacture of everything in Russia that is used in Russia. This is leading to an immensely increased cost, especially of the rails and other iron work of their Siberian railroad, and in almost every other branch of their undertakings. They are still dependent largely upon Great Britain and this country for their locomotive engines, but they are making desperate efforts to establish great locomotive works. Very large profits insure in all large branches of work, which are mainly secured by English, French and Belgian capitalists, who have established large iron works in south Russia. Let me say that the impression which any one of close observation gets in Russia of the country and its people, will probably change their conception of the Russians in a very profound manner. In their music, their art, in the aspect of the common people, and in the conversation with men of intelligence whom we met in our various associations, one gets the sense of immense vigor and suppressed energy, and of reserved force bound up under archaic conditions. Russia represents the Middle Ages, torn and rent by the partial application of modern science and invention. Their institutions are probably the best that they could have to keep down anarchy, out of which they are earnestly striving to break. When they do break, the power of Russia will be immensely greater than it now is. It is a mistake to assume that if you scratch a Russian you catch a Tartar. The great body of the Russians are Aryans as truly as ourselves, and the evidence of the Tartar strain is not common. In fact, the

Russians appear to have the power of absorbing and co-ordinating subject races. They have carried order and the beginnings of modern industry into Circassia, into Bokhara and throughout the great sections of middle Asia which they have conquered.

They are terribly burdened with their huge army and navy, not, perhaps, as much as Germany or France, but the cost of everything which is made in each of these countries is vastly increased by taking all the best men from time to time, in the prime of life, out from the work of production and turning them to the work of destruction. It then requires the best work of another man to carry the soldier on his back. Many hold that the training in the standing army, especially in Germany, improves the men. Questions which I have put to Americans who have been in charge of great works in Germany disprove this. The workman who has been a soldier stands at salute when the employer appears and is orderly in his action, but to a certain extent and to a very large extent has been rendered incapable of doing anything except to obey the most minute orders. His power of originating has been taken away from him. Had we a standing army and navy in the United States proportionate to our population, equal to that of France and Germany at the present time, it would number about 900,000 men. That is about the number that we have in our railway service. The relative efficiency and cheapness of our production that ensues as compared to the army-ridden nations may be measured by comparing the relative service of 900,000 men upon our railways, with the destructive idleness of 900,000 men wasting their time in camp and barracks, while the women do the scavenger work of the streets, mix the mortar, carry brick and mortar on platforms to the top of the highest buildings, where the masons lay the bricks. They may be seen in every type of work of this kind in Berlin, in Vienna, and in the finest cities of Europe. One can have no conception of these conditions until one studies the condition of foreign countries from the economic standpoint.

GROWTH OF THE MODERN FACTORY SYSTEM.

ALFRED M. GOODALE, Boston, Mass.

The *London Times* in a recent editorial says, "No class in the community has more reason to be satisfied with the results of the last sixty years than the workingmen. It was the utmost demand of their best friends at the beginning of the present reign, that they should be free to work out, by combination or otherwise, in their own way, their own salvation; that their societies should be legalized, and that the criminal law should not be used to increase the power of capital — in a word, that they should suffer from no disabilities. They find themselves in 1897 in the position of a favored class, fenced about with special legislation, and possessed of some rights denied to others, and this period has also been for them one of unexampled prosperity. Their wages have risen, while the price of food and most articles of consumption have fallen. The State educates their children gratis. The State makes the acquisition of allotment easy for them. The municipalities give them recreation grounds and free libraries; if they save, the State finds them an investment without risk, and pays them interest at a rate which they would not always obtain elsewhere. One of the latest acts of the House of Commons was to approve a measure which, surpassing the dreams of labor leaders of sixty years ago, binds the employer to compensate an injured workman, even if the former is blameless. These ameliorations were not in the main extorted by labor leaders from a reluctant oligarchy, nor were they the work of 'popular,' to say nothing of paid, politi-

cians. The factory acts, which have placed a large collection of the British operative population in a position envied by the same class in other countries, were freely granted from above, with no idea of propitiating a class of voters".

The above editorial states the present condition of the factory workers in England, and it is the object of this paper to show the early conditions of these workers, the granting of the so-called factory acts, and the evolution of the modern factory system, a subject of deep interest and great importance, on account of the changes it has made in the people, in commerce, and in local and national legislation in England in the past century and a half. The term "factory system," broadly speaking, applies to the manufacture of all the varied products of machinery; but its inception was in the inventions of HARGREAVES, ARKWRIGHT, CROMPTON and WATT, and we can most easily follow its growth, by considering it as applied to textile fabrics. Its beginning was in 1719, and the starting of a silk mill in Derbyshire by Sir THOMAS LOMBE in this year gave the first trial of a system, that from the start has grown slowly, gradually, irresistably, until to-day we can only venture to guess vaguely at its future. This mill is thus described in ANDERSON'S "History of Commerce": "There were 26,586 wheels, and 97,746 movements which work 73,726 yards of organzine silk every time the water wheel goes round, being twice in one minute, and 318,504,960 yards in one day and night. One water wheel gives motion to all the other movements, of which any one may be stopped separately without obstructing the rest." Considering this mill as the starting point, we must look for a moment at the condition of labor prior to 1719. The condition of the working classes showed plainly two distinct labor systems: first the labor of the isolated individual, that had existed from the time of the primal curse, on the farm, in the forests, and in the shop. Next the system of cottage industry, where the whole family worked together, either with or without outside assistance, the labor being entirely by hand. This can properly be termed the "domestic system". At this, the close of the nineteenth century, examples of this

form of industry can be studied in the mountains of North and South Carolina. It is, necessary but rather difficult to realize that the time which we are now studying is not far removed from the evil influences of the feudal system. It was master and man in a sense that it is hard for us now to understand, so arbitrary was the power of the one, so degraded the condition of the other. There was at this time no law on the statute books of England, bearing on the relation of master and servant, except a few of a criminal character, all in favor of the master. The carding, the spinning, the weaving, were all carried on in the houses or the hovels of the laboring classes. The space for work and sleeping accommodations was in most cases greatly restricted. The air was bad, the food worse, and morality was chiefly noted by its absence. Intelligence had small chance against the gross superstitions then prevalent. Because of this system, and under it, came the pauper class of England, which increased until for its support was used one-quarter of the nation's income. GREENE in his short history of the English people says, "There was no effective police, and in great outbreaks the mobs of London and Birmingham burnt houses, threw open the prisons and pillaged at will. The criminal class gathered boldness and numbers in the face of ruthless laws, which only testified to the terror of society, laws which strung up twenty young thieves of a morning in front of Newgate, while the introduction of gin gave a new impetus to drunkenness. In the streets of London, gin shops invited every passer by to get drunk for a penny, or dead drunk for two pence". The new mills when first started, could look for their supply of labor only from the huts and hovels of the domestic system, and large towns gradually grew up in which the conditions were worse, instead of better, than under the domestic system. Feudal authority was still practically sanctioned by law, and the masters used their power unscrupulously. No efforts of any kind were made to improve the condition of the operatives, and for some time after the birth of the factory system, the opera-

tives were more degraded, more exploited, more abused than before.

Here we must consider the subject from two points of view, the first having to do with the material growth of the system.

Commencing with the year 1719, the growth is slow until 1774. We find mills built in various localities between these dates, worked in most cases by animal power or water power, using both silk, wool and cotton. The application of factory machinery to flax spinning was in 1787. Perhaps the one date standing out most strongly is 1769, for it was in this year that ARKWRIGHT was granted patents for his cotton spinning machinery, and in 1770 and 1771 he with two others built their first factory. This was run by water power, and gave the name of "the water frame" to his machine, and to his product the name of "water twist", names that have lasted till the present. This mill was successful, and in 1774 "the first of four splendid mills" was erected at Belper, and from this time the principle of the modern factory system can be said to be firmly established. It will be interesting to discuss this principle briefly, and in so doing I shall quote from several authors. Manufacture may be divided into two categories, that in which the manufactured article, ".results from the mere mechanical fitting together of partial products made independently" and where it "owes its completed shape to a series of connected processes and manipulations". The first is handicraft, the second where machinery plays its perfect part. "Machinery and tools play again different parts in manufacture. A machine is a combination of resistent bodies whose relative motions are completely constrained, and by means of which the natural energies at our disposal may be transformed into any special form of work. Now a tool is far from being this, nor will any number of tools combined become it, unless this relative constraint is placed upon them. The tool is the thing wielded, but machinery is the wielder. A shuttle is a tool, when its operations are directed by the hand, but when a part of a power loom, it is then a portion of a machine, and is wielded by it. We have thus three classes of pos-

sible mechanical operations in production, those in which tools are employed in human hands, those in which these tools are fitted into machines moved by human power, and those in which these machines are no longer set in motion by human power, but by some other exterior impulse. We have also two forms of manufacture, that in a necessarily, and that in a not necessarily, connected series. On the mechanical side, the goal of the modern factory system is reached, when the machinery, no longer moved directly by human power, is applied to the latter kind of manufacture within a building erected for the purpose. This type of industry was new in 1774. In the earlier factory systems all the processes were performed by means of manufacture proper; either, that is, by the fitting together, by human hands, of partial products made independently, or by the conducting them through a series of connected processes and manipulations, with or without the aid of more or less simple machines and tools. In the modern factory system it is the processes themselves that are performed by the machines, and the human hands that only assist them. It is machine industry, not industry merely aided by machinery. In this system the warp and weft are both spun *by*, not merely *with* machinery, are by machinery wound on the shuttle and the beam, and are again by a machine wrought into a web. Here it is human labor aiding machinery, not machinery aiding human labor. It is machine industry. The difference made in the position of the factory worker is fundamental. In earlier factories the human element was the supreme one. Under the modern system, that supremacy belongs to the machine." This supremacy is thus described by DRAPER in his "Intellectual Development of Europe": "In a very short time after the mechanical arts were applied to the manufacture of textile fabrics, so great was the improvement that a man could do more work in a day than he had previously done in a year. That manufacture was, moreover, accompanied by such collateral events as actually overturned the social conditions throughout Europe. These were such as the invention of the steam engine, the canal system, the

prodigious development of the iron manufacture, the locomotive and railroads, results not due to the placemen and officers to whom that continent had resigned its annals, whose effigies encumbered the streets of its cities, but to men in the lower walks of life. The assertion is true that JAMES WATT, the instrument maker, conferred on his native country more solid benefits than all the treaties she ever made and all the battles she ever won. ARKWRIGHT was a barber. HARRISON a carpenter. BRINDLEY a mill wright's apprentice. By the labors of PAUL, or of WYATT, who introduced the operation of spinning by rollers, a principle perfected by ARKWRIGHT, by the rotating carding engine first devised by PAUL, by the jenny of HIGH or HARGREAVES, the water frame, the mule invented by CROMPTON, so greatly was the cotton manufacture developed as to demand an entire change in the life of operatives, and hence arose the factory system. At a critical moment was introduced WATT'S invention, the steam engine. His first patent was taken out in 1769, the same year that ARKWRIGHT patented spinning by rollers. It came at a fortunate time, nearly coincident with the invention of the dressing machine by RADCLIFFE and the power loom by CARTWRIGHT." When one realizes what these inventions mean, on the one hand the spinning wheel with its *single thread* of cotton, wool, worsted or flax, on the other hand, the Amoskeag or the Pacific, the study of the years from the one to the other is most interesting. The gradual working out of one principle, the combination of two or more principles in one machine, and the indefinite multiplication of that machine has rendered possible the two and one-half million yards weekly production of one corporation.

One element in the growth of the factory system of great importance is the steam engine. Bear in mind, if you please, that at the beginning of the eighteenth century, every single element of the modern steam engine had been separately invented and applied practically. Atmospheric pressure, the pressure of gases, the nature of a vacuum, the method of obtaining it, were all understood. Boilers had been made capable

of withstanding any necessary pressure and the safety valve had been invented. The combination of these elements into the steam engine of to-day is the work of many inventors, from WATT and NEWCOMEN to those of our own time, but to this combination we are indebted for the first and indispensible requisite of the modern factory system, namely, power. To sum up the growth from our first point of view, the material side, I quote from WHITE: "In 1767 an eight-handed spinster sprung from the genius of HARGREAVES, and the jenny, with still increasing power, made its way into common use, in spite of all opposition. Two years afterwards the more wonderful invention of WYATT, which claims a much earlier origin, but which had disappeared, like a river that sinks into a subterraneous channel, and now rose again under the fortunate star of ARKWRIGHT, claimed yet higher admiration, as founded on principles of more extensive application. Five years later, the happy thought of combining the principles of these two inventions to produce a third, much more efficient than either, struck the mind of CROMPTON, who, by a perfectly original contrivance, effected the union. From twenty spindles, this machine was brought, by more finished mechanism, to admit of a hundred spindles, and thus to exercise a Briarean power. KELLY relinquished the toilsome method of turning the machine by hand and yoked it to the strength of the rapid Clyde. WATT, with the subtle and more patient agency of steam, moved an iron arm that never slackens or tires, which whirls round two thousand spindles in a single machine. Finally, to consumate the wonder, ROBERTS dismissed the spinner, and leaves the machine to its own infallible guidance. When it is remembered that these inventions are not confined in their application to one manufacture, however extensive, but that they have given nearly the same facilities to the woolen, the worsted, the linen, the stocking and the lace manufacturies, as to the cotton, and that they have spread from England to the whole of Europe, to America and to parts of Africa and Asia, it must be admitted that the mechanical improvements in the art of spinning have an importance which it is difficult to over estimate.

By the Greeks, their authors would have been thought worthy of deification, nor will the enlightened judgment of moderns deny that the men to whom we owe such inventions deserve to rank among the chief benefactors of mankind".

Moving now to the second point of view, we must look at the condition of labor and trace briefly the changes from then till now. I have already mentioned the generally degraded condition of labor under the domestic system. It was vicious in the extreme, and one of the chief faults of the system was pauperism. Legislation, even if kindly disposed, could do but little under this system, for it had to do exclusively with the home, and an Englishman's home is his castle. Legislation would have been resented by the operatives as it was in the beginning and first years of the factory system. Nor was this degraded condition generally known, and it remained for the factory system to first show to the English people the abuses that had been hidden in numberless cottages, by the bringing together of these operatives in factories. The employment of what has properly been termed infant labor, was the worst evil. Infant labor was cheap. It was adapted to the new machines, and an abundant supply was obtained from workhouses established and one of the results of the Elizabethan Poor Law. One authority says, "Under the operation of the factories apprentice system, parish apprentices were sent without remorse or inquiry to be used up as the cheapest raw material in the market. The mill owners communicated with the overseers of the poor, and when the demand and supply had been arranged to the satisfaction of both parties, a day was fixed for the examination of the little children. This was usually done in Manchester, where the children were placed in dark cellars and the mill owners, by the light of lanterns, examined their limbs and stature. A bargain was struck and these poor innocents conveyed to the mills. The treatment they received afterwards depended entirely on the will of their masters. In very many instances their labor was limited only by exhaustion after many modes of torture had been unavailingly applied to force continued action. Discrim-

ination of sexes was not regarded. Vice, disease and death luxuriated in those receptacles of human woe".

Another authority says, "Cruelties the most heart rending were practiced upon the unoffending and friendless creatures who were thus consigned to the charge of master manufacturers. They were harassed to the brink of death by excess of labor; they were flogged, fettered and tortured in the most exquisite refinement of cruelty. They were in many cases starved to the bone, while flogged to their work".

The ordinary hours of work were fourteen and sometimes extended to sixteen. They were occasionally even longer. The operatives rose at five and went right to work, and a breakfast of water porridge was taken in the mill, but the machinery did not stop. Forty minutes were allowed for dinner, one-half of which was used for cleaning the frames. On Saturday they worked till midnight. More, much more could be stated and still only a faint idea be given of this period and its ills.

At the beginning of 1796, a committee called the Manchester Board of Health, was appointed to investigate the general subject, and Dr. PERCEVAL, an eminent local physician, brought up for consideration five resolutions dealing with these evils. They clearly stated and suggested a remedy for them, namely, "parliamentary aid to establish a general system of laws for the wise humane and equal government of all such works". This was, so far as we know, the first time that the question of factory legislation was ever raised. Even at this time all employers were not as just described, but the exceptions only proved the rule. ROBERT OWEN, born in 1771, was one of the men who worked hard for an entering wedge of legislation, and from 1812 to 1829, when he came to America, was constantly before the public, on the side of the workers, in what was becoming known as the factory controversy.

The progress of factory legislation can be divided into three periods. In 1802 Sir ROBERT PEEL had passed through Parliament his "act for the protection of apprentices in cotton mills". An act of but little value to the operative, but valuable

as being the first assertion of the necessity of restrictive legislation. From the date of this act to the passage of Lord ALTHORP'S act is the first period, the second period from then till 1864, and the third period is not yet ended. In the first a definite sense and status were assigned to the term *factory*, and in the second this assumption was sought to be maintained by every possible artifice. The third is distinguished by the ever widening *range* of legislation.

In the struggle between the reformers and the vested rights two elements must be noticed as having a bearing on the solution or partial solution of the points at issue. One is the doctrines of ADAM SMITH. He presented to the people a theory of labor and commerce entirely new to the eighteenth century. He maintained that labor was the chief source of wealth, and that in the nature of things to be most productive must be absolutely free. Another element was the great Methodist revival. The preaching of WHITELY and WESLEY produced enormous results in overcoming the religious paralysis of the time, and aided in the general enlightenment. Some of the most celebrated names in English history are on the roll of those who fought for the factory acts. Beginning with OWEN, already mentioned, Sir ROBERT PEEL, WOOD, OASTLER, SADLER, BULL, Lord ASHLEY, STEVENS, RUSKIN, CARLYLE, DICKENS and DISRAELI may be mentioned. Lord ALTHORP'S act, passed in 1834, was so important in its results that its passage is usually considered the end of the first and the beginning of the second period of legislation. And the third period, not yet ended, gives us the status of the *London Times* editorial, cited as the starting point of this paper.

To sum up so far as possible, consider the wonderful concurrence of events described, the inventions, the changes wrought by them, the ever increasing production, the social and commercial changes, the steam engine, the new theories of political economy, note the mingling of all these in point of time. The result today is transitory. It is infinitely superior to the beginning of the century, but that is all. The end is not in sight and

cannot be guessed or worked out from the premises given. New factors are constantly arising. Improvement will continue, and let us hope the further improvement of the factory system and the conditions of its operatives will be on wise, judicious, and humane lines.

THE COTTON YARN PREPARATION DEPARTMENT OF THE LOWELL TEXTILE SCHOOL.

CHANNING WHITAKER, Lowell, Mass.

The paper which I am about to read relates to a department of the school into whose work the question of the design of the fabric does not enter. But, unless the yarn is a success and skilfully adapted to the design of the fabric, the fabric will not be a success.

THE MOST IMPORTANT RESULT OF TECHNICAL EDUCATION.

In the earlier period of American technical education it was urged by some that while classical education developed the natural abilities of men it failed to fit them for the duties of life, and that technical education was superior because that fitted them for those duties. Others thought that even if technical education was thus utilitarian, it would necessarily fail to develop those finer characteristics of manliness which were the natural results of classical education. Within the recollection of the writer, there were in the technical schools teachers whose fundamental aim and loftiest effort for their pupils was to promote the acquisition by them of scientific principles and practical arts. But gradually the important fact came to be appreciated, that the fundamentally noticeable and important result of excellent technical education, which completely overshadows its purely utilitarian result, is the part that it plays in the making of the man. In technical, as in classical, education the training is of

first consequence and the subject-matter, secondary. What MOXOM has so well said of education in general might have been said of technical education with equal truth: "The end of education is not knowledge simply, nor skill, nor power to do things, but manhood and womanhood. Education is a process, not so much of accretion as of unfolding, and its end is not specific attainments but largeness and symmetry and sweetness and forcefulness of the whole nature."

But technical education is not unimportant from a purely utilitarian aspect. As the beneficent influence of technical education has extended, the rapidity of the advance in every practical art has increased, until the doings of ten or even five years ago in such an art is apt to be ancient history. Even the art of education, of technical education, is no exception in this respect.

LABORATORY METHODS ARE PREFERABLE IN THE CULTIVATION OF MANLINESS AND IN THE ACQUISITION OF SCIENTIFIC PRINCIPLES.

Notice the advance which has occurred in the common methods for the teaching of physics. Formerly, the method most highly approved was that of the eloquent lecturer whose delightful explanations and skilfully conducted illustrative experiments charmed the class. Now the approved method is by the experiments of the pupil under the direction and oversight of the skilful teacher, whether the pupil is in an ordinary high school or in the Jefferson Laboratory of Harvard University. Under modern methods the observing, thinking, acting, pupil has taken the place of the pupil who was acted upon by the lecturer. The fascination which attended the brilliant unfolding of scientific principles by the lecturer of the earlier time can never be forgotten, and one's gratitude to the lecturer will never pass away, but he is blind who cannot perceive the more rapid development of manly qualities and the greater intensity of the delight which naturally attends the personal discovery of truth, when one makes search for it armed with suitable appliances and under the direction and supervision of wise leadership. A

stupid is wholly out of place as the director of a physical labratory, but, given a man who is in every sense the peer of the earlier lecturer, give him the best modern appliances for directing the re-discovery of the known principles of physics by experiment, and you have, in the man and the appliances, better means than formerly for the making of a man, better means than formerly for becoming acquainted with the principles of the science. Under the modern conditions of the laboratory method of education, the teacher has a better opportunity for observing the habits and characteristics of his pupils and for influencing the making of the man, while the pupil has a clearer and a more permanently impressed conviction of the truth which has been the subject of study, and his resultant mental vigor is of a more fearless, aggressive and successful type.

THE LOWELL TEXTILE SCHOOL EQUIPPED WITH LABORATORIES AT THE OUTSET.

It is fortunate for the newly organized Lowell Textile School, that, before its inception, the current, in the older American technical schools, had permanently set toward the laboratory method of education, whenever a suitable equipment could be had, and that the committee of equipment of the new organization proceeded, as a matter of course, to give it at the outset such an equipment as would make laboratory education practicable.

THE COTTON YARN PREPARATION DEPARTMENT.

It will be interesting to look in upon the cotton yarn preparation department, which plays an important part in its cotton manufacturing course, and to learn something of its equipment, its pupils, its teachers, its subjects of study, its series of lessons of the first year, now in progress, and the model for the lessons.

ITS EQUIPMENT.

In the large, well lighted room which has been assigned to this department may be found an excellent example of each of

the machines which are commonly used in the preparation of cotton yarn. They are arranged as they would be in an up-to-date cotton yarn manufactory. There are also separate constructions which exhibit mechanisms or "motions" which are also assembled with others in the complete machines, but which can be more readily studied in detail when they are removed from their usual environment and so mounted as to reveal their peculiarities of construction. Usual appliances have been provided for testing the cotton in the different stages of yarn production. Of very great value is the series of charts, in white lines upon a dead black surface, upon which are shown: first, the features of the processes or of the machines which are the subjects of study; second, the fundamental statements of fact or of principle with which the pupils become familiar; third, the illustrative examples which are worked out in detail; fourth, the problems which are to be solved.

ITS PUPILS.

There are now five classes of pupils in this department. The two night classes are composed of men, most of whom are regularly employed throughout the day in Lowell cotton mills, and who desire to acquire the greater competency in their business which they may gain through the medium of the school.

Two of the day classes are composed of men who have come from Mississippi, Georgia, North Carolina, New Hampshire and Massachusetts. The Massachusetts pupils in these day classes come from Fall River, New Bedford, Worcester, Boston, Waltham, Andover, Lawrence and Lowell. These men propose to devote their entire time for three years to the work of the school. They vary not a little in the degree of their preparation, but all have arrived at, and some have far passed, a certain minimum standard of attainment which is required of all who are admitted to the department.

One night and one day class entered about February 1, 1896. Another night and another day class entered about October 1, 1897.

A third day class entered about July 1, 1897, as a "summer school," intending to utilize the enforced leisure of the then prevalent, now happily disappearing, business depression. So gratifying has been their progress that, notwithstanding the passing of the summer and the revival of business, the class still continues its work in the school. Its members are nearly all employees of the Lowell Machine Shop — overseers, skilled mechanics, draughtsmen — a serious, intelligent, earnest, company. To but very few of these is the course of study utilitarian. To almost all of them it is a broadening of view.

There are in all eighty-eight pupils in this department of the school.

ITS TEACHERS.

Mr. CHRISTOPHER P. BROOKS, who has recently addressed this Association, is, as is well known, the Director of the Lowell Textile School. The principal teacher in this department is Mr. CHARLES C. HEDRICK, who for the past eighteen years has been a trusted employee in the draughtsman's division of the Lowell Machine Shop, where he has had a wide range of experience as a draughtsman, designer, and mill engineer, and where his excellent personal qualities have won for him the respect and friendship of his employers and associates. His assistant is Mr. HENRY MCDERMOTT, a skilled mechanic, who has had long experience in the mill in the erection, adjustment, and use of machines such as those of which he now has the care.

ITS SUBJECTS OF STUDY.

These all relate to the processes for producing cotton yarn or to the machines in which such processes are conducted. They are sub-divisions of the broader subject of mechanics, which is a sub-division of the still broader subject of physics.

ITS SERIES OF LESSONS FOR THE FIRST YEAR

is designed to permit the interested pupil to discover by his own

investigations under skilful guidance: the nature and order of the processes for producing cotton yarn and how to conduct them; the nature of the machines for making cotton yarn and the fundamental facts, principles, and calculations which one needs to understand, if he is to adjust and to use them intelligently. The order in which the questions of the series are taken up is that of the processes to which the cotton is subjected as it passes from its tangle in the bale to its place upon the weaver's cop or beam or upon the bobbin or the cone of the knitting machine. The machines which are particularly considered are: the automatic-feeder, the opener-picker, the finisher-picker, the travelling-flat-card, the stationary-flat-card, the sliver-lap machine, the ribbon-lapper, the comber, the railway-head, the drawing-frame, the slubber, the intermediate fly-frame, the fine fly-frame, the speeder, the ring-spinning-frame, the mule, the spooler, the warper, and the slasher.

THE MODEL FOR THE LESSONS.

The instructor selects for a lesson a subject which is sharply defined, clearly cut, and distinctly separated from the subjects of other lessons. The subject is usually either a process or a mechanism. By isolating it from related or accessory processes or mechanisms he prepares the way for the conception of it by the pupil in a clear and distinct idea. Throughout the whole of the lesson, including its review, he directs the attention of the pupil to this distinctly isolated subject and guards against the diversion of his attention to any other matter. The part of the instructor, in the lesson, is that of a skilful director and supervisor of the work of the pupils of his class. As in the intense blackness of a dark night, an electric search-light directs and fastens the attention of the on-looker upon every detail of the escaping boat, which alone it illumines, so the instructor directs and fastens the attention of each pupil, concentrates the combined attention of his entire class, upon the process or mechanism which is the subject of the lesson. Let us observe them engaged in a model lesson. The pupils have assembled in their

comfortable seats. The instructor unrolls the chart for the lesson of the day. Each pupil studies and then copies into his note-book, the drawing, the writing, the calculations, the data, which he finds upon the chart. At intervals, during the copying, he stops that he may more precisely appreciate the process, the shapes, the inter-relations, the functions of parts, and their mode of operation. When the copying has been completed, he leaves his seat and going to the machine to which the chart pertains, identifies and continues his study of the process, the parts and their mode of operation. This period furnishes the best opportunity of the lesson for questioning either instructor as to any point which the pupil has failed to work out to his own satisfaction. In the note-book of the wise pupil are promptly written the results of his own observations, discoveries, questionings. Soon, the last pupil has completed his copy, the hum of the electric motor is heard, the operation of the machine is witnessed, and the pupils in turn take the place of the usual operative in performing some act of dexterity or skill which relates to the lesson.

While the pupils are studying the chart and the machine, the eye and the mind of the instructor is always upon them. His mind is as free as is possible from their subject of study. They are investigating a process or mechanism, which is a subject of study. He is investigating the characteristics of individual pupils. The most important examination of the notes of each pupil has the discovery of his characteristics chiefly in view. To understand and to mould these characteristics is his most important work. To attempt to mould without thoroughly understanding them would be folly. Said a wise manager, whose mill roof was being laid, of the contractor who was doing the work, "His foreman drives as many nails as any of his men. Unless he sends someone here, who will keep his hands in his pockets, there will be a big bill for him or for me to pay." Somewhere in the twenty-four hours, the teacher must have time, must have leisure, to think of, to influence, the characteristics of the individual pupil or the pupil's best capa-

bilities will not be developed and will be lost to the world. Preferably, just before the taking up of a new subject comes the lesson in review. Preferably, by quizzing the teacher draws out of the pupils the whole story which the lesson was intended to teach. If a pupil has drawn a wrong inference, wise questioning will set him right. More by quizzing than by statement, but certainly somehow, the whole story of the lesson is correctly told in the review. The wise pupil revises his notes as the quizzing proceeds. Then all pass to a new lesson and to a new subject.

THE CAUSE OF THIS DEPARTMENT.

It is well for this School and for its future that it had as a member of its initial board of trustees and of its committee of equipment a man of iron determination and of large acquaintance with young men and with the manufacturers of the entire country and their needs. The local manager of the largest American manufactory of textile machinery, he was well acquainted with the difficulties which are experienced by young men who desire to enter the textile industries but who, having completed their studies, lack the practical acquaintance with textile matters which will give to such of them as are without friends an introduction into the business. He was equally well acquainted with the annoyance to the mill manager and with the damage to his business which results from the necessary employment of the best available, but incompetent, subordinates in mills all over America in which cotton yarn is an element of the manufacture. He determined, through the not yet created instrumentality of the cotton yarn preparation department of the school, to qualify such young men and thus to bring them, the mill managers, and their business together. His determination settled the question. He secured the co-operation of his committee consisting of Mr. ALVIN S. LYON, chairman, Mr. EDWARD W. THOMAS, and himself, and of the President of the Trustees, Mr. ALEXANDER G. CUMNOCK, and a vote by the Trustees of full power for his committee. He secured

as gifts, from the KITSON MACHINE COMPANY of Lowell, the feeder and the pickers; from the MASON MACHINE WORKS of Taunton, the sliver-lap-machine, the ribbon-lapper, and the comber; from Mr. T. C. ENTWISTLE of Lowell, the accessory card-grinders; from Mr. W. W. CARY of Lowell, shafting and hangers; and from the LOWELL MACHINE SHOP of Lowell, all of the remainder of the magnificent machinery of instruction of this department, amounting in value to thousands of dollars. Not content with this, he has maintained a continuous and active interest in the practical success of the work of instruction. The entire LOWELL MACHINE SHOP, the organization of which he is the local executive, has caught the spirit of the undertaking and has united with him, Mr. CHARLES L. HILDRETH, in the endeavor to ensure its success. That so valuable a man as Mr. HEDRICK, one so familiar with the "trade secrets" of the organization, should have been released to the school as an instructor, is one of the proofs. There is no reasonable request, which is made of this organization by this department, which is not granted at once without cost.

WHAT SHOULD A YOUNG MAN KNOW?

Once, while revising a course of study for mechanical engineers, I called upon a number of prominent mill managers and put to them the question, "If you could decide what a young man should know, after four years of preparation to enter your employ as a mechanical engineer, what would you have him know?" One replied, "I should not care what he knew. I should take him into my mill, and give him a problem to work out which he doubtless had never seen before. If he should solve it with intelligence and success, I should keep him. If not, I should not keep him two days."

THE LOWELL TEXTILE SCHOOL AS A SCHOOL.—AS A TEXTILE SCHOOL.

The fundamental purpose of the Lowell Textile School is the promotion of manufactures, and very much to this purpose is

expected of the best men who shall graduate after having gathered the full preparation which the school can give. But, more than anything in the way of knowledge of textiles, diploma, or degree, the personal characteristics of the graduate student will determine the extent to which he will be capable of promoting manufactures. Is he well qualified by nature? Is he disciplined? Are his powers of body and mind and spirit under his complete control? Has he a right purpose? Does he shun alcohol, tobacco, and other narcotics, sensuality, and profanity? Has he physique, brains, endurance, forethought, judgment, cordiality, courtesy, common sense, good taste, breadth of view, push, dash, persistence, industry, system, integrity, conscience, tact, energy, vim, will-power? Has the school caused the finest characteristics of manliness, which are the most valuable of scholarly attainments, to develop and ripen, while yet the mind is intent upon fibres and fabrics, colors and chemicals, machines and processes, drawings and designs, books and pupils, teachers and trustees? The Lowell Textile School will be good as a school, to the extent that it exercises a forceful and beneficent influence in the making of men and women. It will be good as a textile school, to the extent that it influences the bounding life of an excellent, intelligent and well equipped manhood and womanhood to devote itself to the promotion of textile manufactures.

The PRESIDENT. The papers for the afternoon have been concluded, and the remainder of the time will be devoted to an inspection of the Museums under the lead of Professor WILSON and his co-adjutors, but before we leave the room I will call upon Professor WILSON to make a few remarks upon the functions of this institution and also upon the arrangement of the exhibits.

Prof. WILLIAM P. WILSON. I want to make two or three remarks before we start out to get some idea of this institution. In the first place, it is organized under the municipality of Philadelphia, and there has been chosen a board of trustees, elected wholly by councils at first, and with the higher officers of the State and the city always members *ex officio*, and the vacancies always filled by one branch of councils and approved by the mayor of this city. Aside from this board there has been organized, in order to make this institution broader than a city institution, broader than a State institution, in fact a national one, an advisory board, adjusted and ordered in such a way that all the chambers of commerce and boards of trade and trade organizations in the United States, as you know, have been invited to put two members on this advisory board. As this institution had for its work the extension of trade into foreign countries, it was deemed advisable to come into communication and relation with foreign chambers of commerce, and this advisory board was therefore extended to all foreign chambers of commerce in Latin-America, and is being extended at the present time to Africa, Australia, China, Japan, India and Europe. We receive reports from those chambers of commerce. We are in connection with them for information and for giving out information. As we had much to do in the collection of materials with the various governments, both on the American continent and on the eastern hemisphere, we also organized an honorary diplomatic board, and at the present time every minister of Latin-America is a member of this diplomatic board, and these ministers have been here and organized under a head, and have several times attended meetings here and done business in this institution. This aids us greatly in the arranging of our raw products and in settling our relations with foreign countries.

The departments of this Museum are arranged into a department of raw products, in which we have attempted or are beginning to attempt to collect the raw products of the world

which may be used in manufactures, and we frankly say we have the largest collection, here in this series of rooms in this Museum, that exists anywhere in the world; then the department of manufactures, in which we have at the present time gathered together about 100,000 samples, every one of which is made in a foreign country, and every one of which enters some market which you ought to compete in, and from every-one of which we have data with reference to the manufacture, the wholesale prices and discounts, and the conditions and distribution of these products. Outside of this we have a bureau of information which is supported by a large library, to which all the different governments contribute, by invitation, their publications, and to which the trade journals from this and other countries are sent, to the extent of 1,000, almost invariably free, because we have shown that this is a free institution practically, supported by the city and by the State. This bureau of information, in conjunction with the manufactured products, has for its special study the markets of the world and in what way you can better enter these markets, where are the competing points, the differences, and all the questions which will aid you in putting your goods into foreign commerce.

I want to say a word on the sources of information of this bureau. In the first place, we are connected at the present time with over forty chambers of commerce. We are connecting ourselves very rapidly with all chambers of commerce in the Orient outside South America, Central America and Mexico. We have the privilege of using the consular service of the United States. We are most vigorously using them, sending out tens of thousands of blanks in Spanish and other languages, to be filled up by those consular agents. We get most efficient service through the foreign chambers of commerce. Such chambers of commerce as that of Caracas in Venezuela, make us complete reports of the different lines of European goods going into that market of Caracas, and send us samples. We have over 700 samples from the Caracas Chamber of Commerce. At the same time this chamber of commerce has made us up a

semi-official list of all the business firms in the various cities of Venezuela. You can see the value of that at once. These firms are classified in such a way that we know the ones who are handling cotton goods or commission houses. We know those who are handling leather and various lines. This we are having done in all cases. We are also in communication at the present time with about 3,000 different firms, to which firms we have offered to make a card catalogue in our country, in order to put them in communication with the manufacturers of this country. The larger business firms came at once into correspondence with us, and offered as a free gift information of all kinds which they can give in the markets where they are located. In return we give them all kinds of free information of this country, and put them in touch with the manufacturers by sending catalogues or doing anything to open them up to the interests of trade that they want to reach in this country. In that way we get an immense amount of necessary and valuable information from expert firms.

One word further about the support of this institution. The city of Philadelphia has given this institution $75,000, to be used this year in furthering its interests in any direction which the board agrees to, in building up the bureau, and in building up collections both of manufactures and of raw products. One hundred and forty-three thousand dollars has been asked for the coming year, and I believe it will be granted, to be used in this bureau. At the present moment, not having sufficient funds for this institution, a transfer has been asked for. This is now a municipal department of the city of Philadelphia, and I presume by this hour a grant of $10,000, transferred for the rest of the year, has been given this afternoon, as it was to be acted upon by councils and had been reported favorably by the finance committee. That makes $85,000 for this year.

The city has already set apart two valuable pieces of land, adjoining each other, first one and then the other, including now 46 acres of ground. The first, 16 acres, was not considered large enough for the buildings and ground to surround the

property with the proper land, and a proposition to grant 30 acres more has been recommended by committees and is to be acted on finally this afternoon. This land is to be placed in an economic garden, in which plants shall be cultivated which represent the economic products of the world.

The State this year gave this institution $50,000 to be used in maintenance and building. It was intended, however, by the trustees, to use this entirely in building for the future. There is at the present moment $200,000, which was at one time favorably acted upon by councils, but which is now to be referred to the people, in a loan, the validity of which I hope will be passed during next week, to give this institution $200,000, to be employed in the erection of a permanent building. This appropriation was voted at a public election in December.

I would say that the group of buildings here, including this five-story building, the adjoining four dwelling houses, which have been cut in on the second story, numbering about 30 rooms outside of this building, and a six-story building back which is approached by bridges, numbering all together 100 rooms here, are filled, is donated entirely by the Pennsylvania Railroad, no charge whatever being made except that we pay the taxes to the city and that we pay the insurance. The taxes have been reduced by the city to almost nothing, and the insurance is taken care of by the Pennsylvania Railroad for a minimum. That is the status of this institution at the present moment.

Before you see it I want to say now that as you leave this room — I ought to say I have omitted one word in the line of support, and that is this. The bureau work, as you will see when you get in it, as we are going there next, is designed to benefit every manufacturer in the United States alike. There is nothing in the bureau and nothing in the work, in the securing of information and sending out reports, which may not benefit a man in Chicago or St. Louis or San Francisco or Boston, just as well as in Philadelphia, and I had almost said we are better known in some of the cities some hundreds of

miles away from us than we are in Philadelphia, because our Philadelphia people, while they are supporting us most vigorously, having our institution under their eyes, are always going to come into it but are putting off the evil day, while hundreds of people come here from remote cities and go out of their way to come to Philadelphia, having heard of the institution and feeling that they may be benefitted by it. I therefore wish to say that this institution designs to benefit every manufacturer in the United States alike. The bureau work, therefore, has a small subscription fee to it, which, however, is sometimes more than covered by the typewriting of the report sent out to a given individual firm. It is designed eventually to have the bureau part of it — not the Museum part but the bureau part — supported by the manufacturers who use it. If the bureau part was used by the mass of manufacturers in the United States the subscription might be reduced to $10. At the present time it is $50. There is no inconsiderable sum at the present time coming in from the support given by manufacturers. About 200 manufacturers in Philadelphia are members, many in other parts of the State, many in Pittsburgh, many in all the larger cities of the country, including Cincinnati, Cleveland, Detroit, Chicago, and running west as far as San Francisco.

There are some features in this institution which you may choose. It will take you four or five hours to walk through the different rooms alone. The cotton exhibits, I take for granted, you want to see. In them at the present time I dare say we have probably 60,000 samples. You know how those duplicate and run up when you get 500 or 800 samples of calicoes almost the same. We certainly have over 50,000 samples of cotton goods. Outside of that we have an exhibit of wools here which I think is not equalled anywhere in the world. It includes almost every wool and hair that ever finds its way into this market or any other. We have also large exhibits of hides and wild animal skins. In the wild animal skins there are over $7,000 worth such as are used in commerce. We have very extensive exhibits of fibres on the lower floor and also in other

rooms. The arrangement here is in accordance with two methods. The geographical arrangement begins on the second floor in front, with Mexico, in which there are six rooms and a hall devoted to nothing but Mexican products. Running around to the right you will find Guatemala with two rooms, Costa Rica with four rooms, and so on around. We ascend from the second floor to the third, and so on up in that way with the geographical rooms. On the first part of the second floor there are monograph exhibits, where if you wish to see tin blocks you will see tin blocks. If you wish to see gums and resins they are in one room. If you wish to see economic minerals they are in one room, or animal fibres, they are in one room. The animal fibres include an excellent collection of wools and raw silks. The wool room of which I speak, is in the six-story building back of us, connected with a bridge. You will find there samples including from one to fifty pieces of a kind. All together not less than six or seven tons of wool are in that room.

In order to give an idea of this institution, if you will follow me I will take the liberty of asking you to walk up one flight of stairs to the next floor. On the next floor we have an exhibition of samples of cotton goods, and that is what you ought to see first of all. You can go as much further as you please. We walk up to that room at the end of the hall. As you go up you will find on the right Japanese materials and goods, on the extreme right at the end of the hall such goods as you would have to send to Turkey, and on the left there are other goods. These goods in Turkey are made in Turkey. Most of the goods are made in England, France and Germany and are exported to this country. As you go along in the hall on the north are six or eight apartments filled with cotton and other goods. Directly over us is the library, a bureau which I want you to pass through. If you will follow me we will go first to the upper floor and pass into the library and direct into the bureau from this side of the hall.

SIXTH SESSION.

THURSDAY, OCTOBER 28, 1897, PHILADELPHIA TEXTILE SCHOOL.

Meeting called to order at 8 P. M., President RUSSELL W. EATON in the chair.

The PRESIDENT. Gentlemen, I have great pleasure in introducing to you Mr. CHARLES HEBER CLARK, publisher and editor of the *Textile Record*, Philadelphia.

PHILADELPHIA AS A MANUFACTURING CENTER.

CHARLES HEBER CLARK, Philadelphia, Pa.

I do not know that I have any natural right to answer for all these people in all these organizations which have been thanked here to-night. I am very sure, however, that I have the right to speak for the Entertainment Committee of which I happen to be a member; and as I am the only Philadelphian who is to speak this evening, I believe I will take the liberty of saying we are very much obliged to you indeed for the kind things you have said of us. I assure you it gives to Philadelphia people a great deal of pleasure to entertain agreeable persons, and I am certain it will be the verdict of all our committees, and of all individuals who have come in contact with you, that while you have had a great deal of pleasure, we have had a great deal more even than you have had. We shall look forward to the opportunity of seeing you again, both as an Association and as individual members of the Association. We wish you the highest degree of prosperity; and we express the same wish for the great cotton industry which you represent. It is not my purpose to-night, Mr. President, to undertake to make a speech. There are great masses of solid wisdom to be bestowed upon this meeting after I conclude and so I would use this opportunity to indulge simply in some informal, loose-flowing talk. At the outset I want to say that it is very embarrassing for a Philadelphian to speak to strangers about his own city. It is almost as unbecoming for a man to do that as to boast of himself; but everything in Philadelphia, as you have had an opportunity to discover, is so splendid that to speak about the city at all we

must use language which, to the uninformed, will appear to be extravagant. It looks like exaggeration when I say, for instance, we have within the boundaries of this city one thousand miles of railroad track, enough to go one third the distance to the Pacific coast; and when I say we have 33 miles deep-water river-front, it seems almost beyond belief; yet, Mr. President and gentlemen, these are solid facts; and it is a fact that we have in Philadelphia the largest shipyard in the United States, and the greatest locomotive works; we have the largest retail store, the most commodious commercial building in the whole world; but you have seen that this afternoon. We have the two most elegant railroad stations, I suppose, on the continent. We have the largest park; we have the greatest number of miles of asphalt streets, and we have the lowest death-rate. These are facts, and they are facts of which it is impossible not to feel proud when we speak of Philadelphia. Philadelphia, however, is chiefly a manufacturing city; it is in a very peculiar and distinct sense a manufacturing city. I suppose that if a man should throw a stone on one of the streets of this city in any direction it would hit a manufacturer, or the man who drove a wagon for a manufacturer, or the man who sold goods for a manufacturer, or the man who insures a manufacturer, or the man who has a mortgage on a manufacturer's property. [Merriment and applause.]

We have in this city, I suppose, about six hundred million dollars invested in manufactures. The products probably range from seven to eight hundred millions, or about one-half the total manufacturing product of fifteen Southern States; and behind this great city we have the Imperial State, the only State in the Union that borders upon tide-water while the other end touches the Great Lake and the river systems of the Mississippi valley. It is a State which mines 58 per cent. of all the coal products of the United States, produces one-half the pig-iron made in this country, and one-half as much as the British Isles; two-thirds of Bessemer steel and more steel rails than are manufactured in Great Britain. So you see we have here a great and magnifi-

cent industrial community; probably, considering everything, the greatest single industrial community in the whole world.

I have been asked to speak particularly to-night about Philadelphia as a textile manufacturing center, and I shall do so very briefly; and here again we encounter facts that are almost impossible to deal with without appearing extravagant or boastful. In Philadelphia we manufacture nine-tenths of the carpets made in the United States, some of them, it will not be too much to say, equal to the products of the Orient in beauty of design and durability of fabric, and ranging from the highest and most costly down through all the grades until we reach an attractive and ingenious combination of cotton and cow-hair. Our honorable Mayor spoke to you yesterday, and I was very much interested in his speech. He always speaks well. He said, "It always aided men in these matters, in their production of fabrics to have what we may call religious fervor." Now whether there is any religious fervor in the production of Oriental carpets in this city I do not know, but I think without doubt you will agree with me it would be pretty hard to discern any element of religious fervor in the fabric of cotton cow-hair to which I have alluded. [Laughter and applause.]

When we come to the textile fabrics of Philadelphia, gentlemen, the field is so large I have found myself unable to commit the list to memory, and if you will have patience with me I will name a few of the textile fabrics produced in this city: yarn, cotton, woolen, worsted, silk, jute and fancy calicoes, dress goods, batting, Turkish toweling, terry cloth, counterpanes, quilts, table damasks, chenille curtains, table covers, woolen carpets, rugs, mats, men's wear, dress goods, blankets, lap covers, upholstery goods, furniture covering, draperies, plushes of worsted, silk, mohair and jute; braids, fringes, furniture gimp, lace curtains; silk and satin, silk ribbons, silk damasks for draperies, elastic webbing, hammocks, school bags, burlap bags, rope and twine, hair cloth. And then in the knitting industry we have about 130 knitting mills, the products of which are: hosiery, underwear, fancy goods, jersey cloth, cardigan jackets, stockinet, astrakan cloth,

elastic surgical hosiery, sweaters and all kinds of athletic goods, leggings, scarfs, knit shawls, mittens, gloves, caps of wool, worsted, cotton, silk and lisle thread.

Then, as you know, we make all kinds of knitting machinery, which is probably not at all inferior to that made elsewhere. There is a concentration in this city of a number of makers of knitting machines of superior grade. We also make almost all kinds of textile machinery including carpet and other looms, machines for preparing wool, cotton and jute; for dyeing, tentering, sizing, fulling, calendering, singeing. We make belting, vats, tanks, dyestuffs, dyeing and finishing machinery. From this it will be seen that we have a right to regard with pride the magnificence of this textile industry; but we have something more than civic pride in Philadelphia. A good Philadelphian rises above and beyond that: he is a good American. [Applause.] He repudiates the British idea that we should take the wool from Australia and the cotton from America and transport them to the British Islands to be finished into fabric. As Philadelphians and Americans we believe that the greatest cotton-producing country in the world should be the greatest cotton-spinning country in the world. The Philadelphian believes that the woolen mill should be placed by the sheep ranch, that the iron furnace should stand by the side of the mine, with the inevitable result that the manufacturer will pay less, and the man who produces will get more, for the raw material.

Philadelphia is proud of her own industrial achievements, but we are able to look to the North and to rejoice in the wonderful things done for industry there, while we turn to the South and hail the development in that region of a purpose also to accomplish great results. It is an easy thing to say that we have this national spirit, but I come here prepared to prove that we do look to the good of those in our land beyond our own border, and we do rejoice in the promotion of American industry, and are glad to aid that promotion in every way that we can. I will give you two proofs that such feeling is existing in this city. The first one, gentlemen, is found within the walls of this build-

ing, the best textile school in the whole world. It is an achievement of Philadelphia, of Philadelphians. We have a school here, which was started, conducted and supported, not for the benefit of Philadelphia textile industries alone, but for the textile industries of the whole nation. [Applause.] And we are able to turn our eyes to New England and see another great school, a magnificent school, I believe, rising in Lowell; and not be envious of it, but to rejoice to perceive it. We shall be glad not only when there are two textile schools, but when there are more in all parts of the land from one end to the other; textile schools and other manual training schools, where instruction can be gained by men and women how to use their hands as well as their heads, and to develop artisans of our own country in skilled work, so that we may not be compelled, as has been our custom, to import our skilled labor from abroad.

The commercial museum which you visited this afternoon, is another institution founded by Philadelphians and maintained by Philadelphians, which has for its purpose, not the mere promotion of Philadelphia industry, but of the industries of this whole nation. In order to demonstrate that it is so, the people that have charge of it have put themselves in communication with the government of the United States, and they have sought for members of their board of trustees and directors in all the States, and have said to them, Gentlemen, we have set up this magnificent enterprise and succeeded in making this contribution for the promotion of foreign trade, not for ourselves only, but for the whole American people, and we invite you to participate with us in its benefits. We would like to see you thrive as we have thriven. We would like to see other industrial centers rise as this one has risen. One of the reasons we have been glad to welcome you here is that we may be drawn closer together with Americans of other sections, and we will not fail to thank you very much for the kind things you have said of Philadelphia, and for all the things you have said of the various institutions, and for myself. In behalf of the gentlemen whom I represent, I earnestly hope we may have the pleasure of meeting you again.

The PRESIDENT. The eloquent words that we have just heard show us as thoroughly, perhaps, as anything during our visit has shown us, what Philadelphia really is, and I am very glad that we are to close this meeting with these words ringing in our ears. We have seen in this city in the last three days not only this Textile School of which every member connected with the cotton industry is justly proud; we have not only seen the works of the Messrs. CRAMP, with their exhibition of mechanical skill and business management; we have not only seen the Bourse and Museum, designed to widen business and enable those engaged in all trade to throw off its narrowing shackles, but we have seen another thing which before we came here puzzled us. We have seen why these things exist. We have seen some of the men and women who have made these institutions possible. Now the labors of the gentlemen who are connected in an official capacity with all these affairs, of course are very great. We realize that the burdens placed upon them are hard to bear. But their best labors would be paralyzed and their fervor of spirit would be cooled if it were not for the men and women that we have met here in the last few days. They and their associates are standing back of all these institutions and forming the public spirit which will support them. Buildings may be erected, men may have ideas as to advancement of any cause whatever; but if a great underlying spirit spread through the State is not found to uphold these institutions they will very soon abate, and I can see from the gentlemen we have met — the ladies and gentlemen we have met — that it is by them, in their molding of public sentiment, and bringing the minds of the citizens of the State to where they are prepared to support these institutions, that the city of Philadelphia is enabled to do the things that it is doing, and in adjourning this final session of the sixty-third meeting of the New England Cotton Manufacturers' Association, I wish to close with words expressing my esteem and regard for the ladies and gentlemen we have met here, and to say to them it is our fondest wish that in the future we may call them our friends.

COMPARATIVE LIFE OF COTTON MACHINERY AND VALUATIONS.

EDWARD W. THOMAS, Lowell, Mass.

The condition of the general manufacturing interests of the country, particularly in the New England States, the past three years, has brought vividly to many of us the fact that under such a condition we must more carefully consider many questions of policy and management that have hitherto been regarded as secondary matters.

One of the questions for consideration is the one of the practical life of cotton machinery, and closely allied with this is the matter of the true and honest valuation of machinery and of mill plants. The accompanying paper will treat of these matters in two sections: the first upon the life of machinery, the second upon the valuation of a mill plant. The figures given below have been carefully prepared by the best engineers and mill builders in New England, as well as abroad, and are of very recent computation, and are introduced to fairly show the comparative difference in first cost of plants upon each side of the water.

The practical life of cotton machinery must be determined by taking into consideration a large number of factors, all having a bearing upon the question.

Considering, first, the quality of the machinery produced by the cotton machine builders of to-day, it must be granted that it is far superior in workmanship to that built ten years ago. Not only as to superior workmanship, but also to the vast im-

provements made in the line of better castings, cut teeth (instead of cast) in nearly all gears, contracted space occupied, and the various improvements in the working parts of nearly all machines. Much has been done by the builders in making parts interchangeable, thus saving the manufacturer some of the expense heretofore endured. Anyone at all acquainted with the working tools of our machine builders can by comparison say that the shops are fitted with many special tools, entirely unknown, or at least unused, a few years ago. The keen competition of the American builders among themselves, as well as that of the English builder against them in the market, has in a measure forced them (the American builders) to give a more careful attention to the quality of machinery than has ever been their practice.

The life of machinery also depends much upon the care given it by the operative and overseer, and also in some cases by the management. Cases are undoubtedly known to you, individually, where, from carelessness on the part of the overseer or assistants, departments have been allowed to "run down" and depreciate materially in a length of time too short to be believed. Also, in many cases the false economy often practiced by the management, in not providing experienced fixers, or sectionmen, sufficient and proper supplies and repairs, has hastened the deterioration of the machinery. The rigidity or stiffness of our mill floors in this country, as they have been and generally are built, is an important element to consider. Floor timbers generally of southern pine in our mills, no matter what their size, or the distance from each other, will deflect between their bearings, and at the same time the floor planking having bearings from 8 to 10½ feet apart, and being laid across the floor beams, when loaded down with machinery, will deflect under some of the heavier built machinery in a plane at right angles to the deflection of the beams. In consequence of this, new machinery, when first leveled and lined up on such floors, does not for any great length of time remain in the original perfect alignment. After the mill has been in operation a while, the

vibration, shake and jar of the floors, and oscillation of the building creates more deflection in the timbers and flooring, necessitating relining and releveling of the machinery. We must be bound to admit the superiority of floors in mills built in England and the Continent, in so far as their rigidity and level is concerned, and it must be an obvious fact to the American manufacturer that floors of this character will prevent much of the wear that exists in our mills. This matter ought to receive far more attention than is given to it. Quite a material amount of power may be saved by habitually releveling and relining shafting and *all* the machinery in mills at regular intervals; and I think on this point, that the ease of the running of machinery and shafting, to say nothing about the improved quality of the work obtained, and the saving of some repairs, would pay many times the cost of having the shafting and machinery in proper running condition. It is certainly a mercy to us as manufacturers that the machines we have to deal with, as a whole, have no specially delicate mechanism, and that they will, and do run under circumstances prohibitive to almost any other class of machinery.

The question arises, how long ought we to run our machinery, or what is its practical life? There can be no set rule to determine this, as a great many elements must be considered. Beyond what has been said, we must consider the speeds of various machines, the adaptability of the same to the class of work required, cost of production, and many other features incident to the particular plant under consideration.

But, surpassing any one and all these elements is the one most worthy of attention, viz.: the depreciation due to the continual progress and improvements made in the various machines by the designers, inventors and builders. Practically, the last ten years has settled many special changes throughout our mills. Considering for a moment the more important ones, viz.: the system of revolving top flat cards, for the former single and double carding processes; the four-roll drawing frame, with its increased doublings and electrical working stop motions, as

against the three-roll frame; the fly frame form of roving machinery, as against the Speeder system; the ring filling frame in place of the mule; the introduction of improved spindles, as against the Sawyer and Pearl; improved bobbin holders on spoolers; various commendable improvements on warpers; and last, but not least, the recently improved loom as built by the Draper Co., whose claims, if but half sustained, are destined to make quite a revolution in the art of plain weaving. Napping, finishing and dyeing machinery have also been largely improved during the past ten years, automatic machine work displacing hand labor, with what result to-day? Mills are being, and have been built containing larger number of spindles and looms under one roof than ever before, production per spindle and loom has been increased, labor cost reduced, power saved, etc. And those of us (and we number many) who are in charge of old established concerns, may well look with anxiety to those who have the modern mill plants as competitors. Many of us are tied up with localisms and limitations that have descended to us from former years, but what can be done? We have nearly, if not quite, reached a point in manufacturing when new elements must be more carefully considered, as, with our southern friends making such rapid strides in mill building, and the increased consumption of cotton, to say nothing of the continued activity shown in Japan and China in the building of mills, it looks as though the northern manufacturer must take every advantage offered in the line of improved plants, larger productions, consolidations and reduction of all possible running expenses. The following is introduced as an object lesson, relating particularly to consumption of cotton in the southern mills:

GROWTH OF SOUTHERN MILLS.

The following table of cotton consumption, bales of 480 pounds, in southern and northern mills, is from the report of H. G. HESTER, secretary of the New Orleans Cotton Exchange, just published:

Year ended August 31.	By Southern Mills.	By Northern Mills.
1887	401,452	1,710,080
1888	456,090	1,804,993
1889	479,781	1,785,979
1890	546,894	1,799,258
1891	604,961	2,027,362
1892	686,080	2,190,766
1893	743,848	1,687,286
1894	718,515	1,601,173
1895	862,838	2,083,839
1896	904,701	1,600,671
1897	1,042,671	1,804,680

This shows that during the past ten years the southern mills have increased their consumption 159 per cent., and the northern mills only 5½ per cent. It is true, however, that the relative values of the goods produced by each does not show so marked a difference, as the northern mills have been forced to produce finer yarns and cloths than in 1887 or 1888, and enhanced the value of the production. This is also true to a degree with some of the southern mills. They, too, have tried successfully to make finer goods than ever before, and the cost of these goods is at so low a figure in many cases as to seem to be impossible.

There is no doubt in my own mind, that we are prone to run our machinery too long after it has outlived its usefulness. I think the most successful of the northern mills are those who are ever ready to introduce new machinery when the time arrives that it is felt they cannot run the old with profit, and it matters not to them as to the condition of the old machinery, be it ever so good, out it must go. Contrary to this idea is that of too many manufacturers to retain their machinery as long as it will stand, remodel it, and add all late improvements until compelled finally to sell it for scrap iron after expending nearly as much on it during its life as would have, years before, bought new machinery. A large amount of the machinery removed from northern mills, up to about five years ago, found its way into southern mills, but the management of the latter have learned a very practical lesson, and as a result the southern manufacturer to-

day builds as modern a mill as possible, purchases the *best* machinery in the market, and, in consequence, second-hand machinery business has lost its best stronghold, and much, if not entirely all of it, finds its way to the foundry and rolling mill, its proper place.

Many of us have connected with our mills large repair shops, in order to keep our old machinery in condition to run, and the expense is quite material if we pay the attention to the machinery that ought to be given to it; and upon this point, I am pleased to know that papers are to be read here at this meeting. Our repair shops, especially in the older manufacturing companies in New England, are to-day fitted generally with full equipments of tools for doing any and all kinds of repairs necessary for keeping the machinery in the plants in as good a condition as possible, at a cost per pound of cloth made, that sometimes looks large.

In fully considering the life of machinery, much depends, as has already been mentioned, upon localisms and the general makeup of various elements, including proper management. It is not an uncommon sight in some manufacturing centers, especially those incorporated years ago, to find cards, speeders and looms running that were built from thirty to forty years ago, still doing fair work, but at an expense of production and labor cost. But, there certainly is a time, and a proper one, that comes in the life of all the machinery in our mills, that to run beyond is like sliding down hill. A mill built fifteen years ago ought to be in good condition today, but it cannot compete with the modern mill of today in cost of production, and this latter is the whole basis of comparison. The cost of production is strictly the only criterion upon which the value of any mill plant can be determined.

MACHINERY AND MILL VALUATION.

Our manufacturing friends abroad have given the subject a more thorough study than we have. Keen competition encountered there renders it necessary for the manufacturer to have

the very best tool with which to produce his goods for the market. When the time arrives that any manufacturer abroad finds his competitor can undersell him, he instinctively knows that there is some good reason for it, and it matters not to him how recently his mill was furnished with new machinery, if his competitors have better, he must necessarily lead them by substituting new machinery for old. He does not hesitate, it is life or death with him. He does not consider, as many of us are apt to, that a card ought to run a certain number of years, a mule so many, and a loom so many.

Trespassing upon your patience for a few moments, allow me to give you the text of a letter recently received from one of the largest manufacturers in England: "In reply to your favor of the 14th inst., it is rather difficult to give replies to your queries, as the method pursued in this country varies very much with varying circumstances. Machinery well constructed and well finished, if properly attended to, would work for thirty years, but it is generally found that the improvements which are constantly taking place make it advisable to renew machines (especially mules) when they have worked twenty years, or in some cases less. The best managed and most successful concerns keep their machinery in the best possible state of repair, any other practice would be most unwise and result in ultimate loss. Card clothing should be renewed every six or seven years, and the following repairs made when necessary, which will depend upon the attention given to the machinery: front lines of bottom rollers renewed or repaired, and roller stands rebushed; mule spindles stretched, refooted, and warves all skimmed down to one uniform size; mule roller beams and carriages squared up, and tin rollers balanced; frames in card room respindled, flyers balanced, collars and footsteps renewed or rebushed. Some concerns make a practice of carrying out a portion of these repairs regularly every quarter, the cost being taken as ordinary working expenses; when a large amount is spent on repairs at one time the cost is carried to a suspense account, which is wiped off at a certain rate per quarter. Sometimes the cost of

these repairs is added to fixed stock account, or deducted from the amount allowed for depreciation, but this is not considered a sound policy".

It is indeed a difficult matter to establish a rule applicable even to a few cases for determining the life of machinery. Its life must be of that duration that it keeps ahead or abreast of competition. As has been stated before, localisms, character of the production of the mill, and many other characteristics must be considered. I believe that the time has come, or is fast approaching when we will give far more attention to the condition of our machinery in our mills than ever before. No more striking illustration of the life of machinery can be made than in the press rooms of the great city daily papers. They barely get a press started before there is a new one in the market outstripping the former, and in order to keep in the swim they throw out the recently purchased one and put in the new. We have had a salutary lesson in this in the spindle line. It is but a few years back that the introduction of the Sawyer spindle created an experience of general surprise. Hardly had it been introduced generally before it was supplanted in a measure by the Rabbeth type of spindle, and the extent to which the latter is used is well known, and its merits and saving to the manufacturer has been very ably and fully illustrated by Gen. W. F. DRAPER in his address at the Chicago Exhibition. Keen appreciation of and a prompt introduction of improved devices and systems have come to be an important element to the manufacturer, who intends reaching success in dividend paying; and this is becoming more of an important feature than has ever been recognized. The subject under consideration is an important one and should be commented upon and made a feature of careful consideration, and I trust may be taken up and form one of the subjects at some of the future meetings of the Association.

Mention has been made of the depreciation of machinery due to improvements as an important element in the life of machinery, and I trespass on your patience for a few minutes on the

subject of mill valuations, this subject being closely allied in a measure with the title of this paper.

The northern manufacturer, particularly if located in a city, has many disadvantages in the way of local valuations for taxable purposes. In many instances the mills antedate the incorporation of the city, and have practically given birth and life to the locality, and are the bone and sinew of its prosperity. These facts do not seem to be fully recognized or appreciated by the local assessors, and in consequence in many cases the manufacturing plant has to bear a larger burden of taxation than it ought. The following table will show the spindles, taxes, etc., of several large cities noted for their cotton manufacturing industries:

City.	No. Spindles.	Capital Stock.	Taxes Paid.	Per cent. of Taxes of this City paid by Mills.	Tax per Spindle.
Lewiston,	267,444	$4,700,000	$89,341.00	30.97	$33.40
Manchester,	575,000	7,600,000	176,741.85	33	30.7
Lowell,	840,000	10,150,000	204,346.00	16	24.3
New Bedford,	1,272,716	11,850,000	245,459.97	26	19.3
Fall River,	2,798,050	23,072,000	566,625.00	46.20	10.25

For the year 1897 the cotton mills in one of the large cities in the foregoing table are valued as follows:

Plant.	Valuation of Machinery per Spindle.	Valuation of Mill Buildings per Spindle.	Spindles. Approximate No.
A,	$4.32	$1.73	48,000
B,	4.83	2.03	154,000
C,	5.82	4.85	110,000
D,	5.42	5.14	70,000
E,	5.76	3.21	120,000
F,	5.51	5.06	160,000
G,	5.50	3.31	182,000

There does not seem to be any general system in use by local assessors whereby their valuations are made, and the excessive

valuations placed upon mill properties in the New England States generally is a great burden. For many years the valuation of machinery in each of the large mills in Lowell was on a basis of $7.00 per spindle, irrespective of whether the mill was coarse or fine, whether it had any auxiliary machinery or not, in the way of finishing, bleaching or printing. Several cases were carried into court, appealing from such valuations, and notable reductions were made in many instances by parties hearing the same. I only speak of the above to show the fact that this subject of depreciation and present value of mill plants is very lightly understood, and ought to receive more careful consideration, in order to assist and foster an industry that in our New England States needs all the assistance that can be given it. The valuations put upon mill property of equal productive capacities, manufacturing the same class of goods, located at different centers, is quite varied. In some instances the taxes have been exempted for a term of years in case of building new mill properties. For taxable purposes, no specified valuation should ever be placed on the *individual* machine of the mill plant, for it is simply part and parcel of a unit for productive purposes, and said unit should be considered as a whole. It matters not as to what the machine originally cost, but it does matter considerably whether the whole plant, with its buildings, power, tenement property, proximity to accessible freight facilities, nearness to labor market, is a good, bad or indifferent tool with which to manufacture with economy. Local taxable valuations too often are based on the amount of brick and stone in buildings, and the amount of machinery and other tangible property. Its valuation as taxable property should be based on its market value, productive capacity, dividends earned, and not on cost or what it may have done five years before. In some localities, mill plants are actually assessed for more than they could be built complete for at time of valuation; this has been proven times without number. The question of local taxation has been brought to the attention of the courts in Lowell, Lawrence and Fall River, within the past few

years, and much benefit has been derived to the manufacturer from the decisions as given by the court. In every instance that I am acquainted with, that has been tried before a county commission or a justice of superior court, notable abatements have been granted the petitioners. In Massachusetts the State tax commissioner has, practically, rules laid down for his guidance in levying the State tax, and the most important is that based on selling price of the stock, as on May 1st of each year, taking the number of shares of the capital stock and multiplying by the market value as of the above date. From this amount is deducted the surplus of the company, if any, and the balance is said to be the value of the taxable property in the city or town in which the mill is located. What better way of valuing mill property is there than this? It certainly is worth no more than the community are willing to give for it in the open market. But the tax commissioner frequently finds that his valuation is exceeded by the local valuations of the assessors.

Taking another condition of valuation of a mill plant, that of value to the owner. In the machinery line, it is very evident that as long as any machine in a mill is productive as such, even if thirty or forty years in use, it has a value more than its worth as "junk," but that value must necessarily be low on account of its form, amount of production and the other various limitations connected therewith.

In valuing a mill plant, not only does depreciation due to improvements in machinery come under consideration, but the depreciation due to the improvements made in our power plants and buildings. Our old power plants, whether steam or water, are not to be compared with the present economic forms. The substitution of compound and triple expansion engines for the plain condensing engine; the horizontal turbine, requiring practically no wheel pits, for the old style upright wheels; the substitution of iron or steel tubing laid in the ground for conducting water to the wheels from upper level canal, or river, and tubes to conduct the waste water away, in place of the former system of expensive feeders, forebays and raceways; the improved

methods of driving from engines and wheels into mills; from using four pounds of coal per horse power per hour down to about 1½ pounds per hour in steam plants; efficiency of turbines increased from 75 per cent. up to 85 per cent. All these modern ideas are found in mills as built of today, and against which we must compete. Great stress has been made for years that a mill located adjacent to water power greatly enhanced its value. That impression is gradually vanishing like the mist. While it may have been true up to a few years ago, it has lost its value as the chief factor in locating a mill plant. By the great improvements made in electric transmission, mills may be built almost anywhere *but* at a water power site, if such locations are more favorable from the prominence of other factors.

We are far behind our English friends in the matter of running machinery. The sinking fund, carried on by them, enables them at the proper time to remove their old machinery and replace with new, and the custom has this advantage, that it certainly keeps the excellence of their machinery at the highest point at all times, reducing their repair account and obtaining at all times the full benefit of all the improvements that are continually being placed in the market. And on this point, and at this time, it might be well to compare the costs of mills both here and in England. From figures obtained from the best authentic sources both here and abroad, taking as a basis a mill plant of 1,000 looms on sheetings, and the cost in this country for plant complete, except land, is about $15.00 per spindle, while the entire cost of mill on the other side would not be over $8.50 per spindle. The spinning mill today can be built and equipped in England for from $5.00 to $5.50 per spindle. This certainly gives the English spinner a great advantage, in so far as capital is concerned. The English manufacturer also has other advantages over the American in many ways: less wages and a more direct method of buying of the stock for, and selling the production of the mills; rent of new sheds for weaving in England, all complete, filled with weaving machinery ready to

run, about $10.00 per loom per year. Tenant pays taxes, furnishes coal and does all repairs.

I give below information given by a gentleman prominently connected with a large number of the greater cotton establishments in England. He says: "Depreciation in general is 2½ per cent. on buildings, 5 per cent. as a rule on machinery, although some concerns use 7½ per cent., and 7½ per cent. on boilers and steam plant. Depreciation each year is on the reduced value, brought forward each year. Income tax assessors allow 2½ per cent. on buildings, 7½ per cent. on machinery, other than steam plant, 5 per cent. on steam plant, gearing, shafting, gas and water piping. Depreciation usually starts after six months' running. Interest is not considered on depreciation account; that is, the money set aside for depreciation can be used without considering interest".

The following table, based on these figures, may prove to be of interest as showing values after some years of service of machinery, the figures representing the percentage either on original or reduced valuations:

Column No. 1 representing the end of each year's use.

Column No. 2 is based upon a depreciation of 2½ per cent. annually on the reduced valuation of each year.

Column No. 3 is based upon same per cent. annual depreciation, but upon original cost.

Column No. 4, 5 per cent. annually on reduced valuation each year.

Column No. 5, 5 per cent. annually on original cost.

Column No. 6, 7½ per cent. annually on reduced valuation each year.

Column No. 7, 7½ per cent. annually on original cost.

TABLE NO. 1.

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. .
1	97.50	97.50	95.00	96.00	92.50	92.50
2	95.06	95.00	90.15	90.00	85.56	85.00
3	92.68	92.50	85.74	85.90	79.14	77.50
4	90.36	90.00	81.45	80.00	73.20	70.00
5	88.10	87.50	77.38	75.00	67.71	62.50
6	85.89	85.00	73.51	70.00	62.61	55.00
7	83.75	82.50	69.83	65.00	57.93	47.50
8	81.65	80.00	66.34	60.00	52.58	40.00
9	79.61	77.50	64.03	55.00	49.56	32.50
10	77.62	75.00	60.83	50.00	43.84	25.00
11	75.68	72.50	57.79	45.00	40.33	17.50
12	73.79	70.00	54.90	40.00	37.30	10.00
13	71.94	67.50	52.15	35.00	34.50	2.50
14	70.14	65.00	49.54	30.00	31.61	
15	68.39	62.50	47.06	25.00	29.51	
16	66.68	60.00	44.71	20.00	27.30	
17	65.01	57.50	42.47	15.00	25.25	
18	63.38	55.00	40.34	10.00	23.36	
19	61.89	52.50	38.32	5.00	21.61	
20	60.34	50.00	36.40		19.99	
21	58.73	47.50	34.58		18.50	
22	57.26	45.00	32.85		17.11	
23	55.83	42.50	31.21		15.83	
24	54.43	40.00	29.65		14.64	
25	53.07	37.50	28.16		13.54	

The figures used by a gentleman in this country, who has had an extended experience in the valuation of mill plants and machinery, are as follows:

TABLE NO. 2.

First	5	years'	service,	5	per cent.	depreciation	on	original	cost.
Second	5	"	"	30	"	"	"	"	"
Third	5	"	"	70	"	"	"	"	"
Fourth	5	"	"	90	"	"	"	"	"
End of	25	"	"	the machinery valued as scrap.					

Taking the depreciation, say at the end of 15 years' service, of machinery, and its value as per tables above would be as per Table No. 1.

First	on 5	per cent.	depreciation	reduced valuation, 47	per cent.
Second	" 5	"	"	original cost, 25	"
Third	" 7½	"	"	re uced valuation, 29.51	"
Third	" 7½	"	"	original cost, 0	"
On basis of Table No. 2,				70	"

It would seem impossible, then, to establish any set rule, inasmuch as opinions vary so much.

The following information, relative to cost of a modern mill plant of 1,000 looms on sheetings, average 28s yarn, may be used comparatively as showing the advantages the English spinner and weaver has in first cost of plant:

	No. 1.	No. 2.	English.
Mill buildings,	$120,000	$114,000	$103,500
Machinery,	272,000	275,000	261,200
Steam plant,	36,000	45,000	34,500
Supplies and furniture,	58,000	45,000	45,930
Freights and starting up,	20,000	22,500	
Heating, ventilating and moistening,	16,000	18,000	
Miscellaneous and contingencies,		14,500	
	$522,000	$535,000	$445,130
Total number spindles,	33,500	30,000	46,080
Per spindle,	$15.32	$17.83	$9.66

Figures in columns No. 1 and No. 2 were furnished by two eminent mill engineers of this country, and the figures in column No. 3 by a large firm in England. As the figures given are estimates and not from actual facts, due allowance must be made in comparing. The large number of spindles required per loom in the English mill will be noticed. The reason for this is the larger production the looms in English mills make over the American loom, as well as the lower production per spindle in ring spinning.

Some concerns allow for depreciation 5 per cent. per annum from the original cost of machinery, others 7½ per cent. per annum *from the reduced amount*, or present value, the latter method making the charge for depreciation higher in the first

years, when the machinery is new, and less in the later years. The depreciation allowed for mill building, steam engines and gearing is usually 2½ per cent. per annum.

A mill built in Oldham to spin average counts, say 28s to 36s warp, and 32s to 54s weft would cost as follows:

	s	d	
Mill building,	9	0	per spindle.
Steam engines, boilers, gearing,	3	0	" "
Machinery,	8	0	" "
Accessories,	2	6	" "
Total,	22	6	" "

This amount might be considerably increased by elaborate buildings and other unnecessary expenses. A mill to spin coarser counts, requiring a larger proportion of preparation machinery, on account of the larger production, would cost more per spindle, as also a fine spinning mill on account of extra roving machinery for double roving, very light carding, etc.

I also append some facts given by another party well known from their large building transactions, not only in England but in foreign countries: "The special commissioner of the *Dundee Advertiser* who is making an extensive inquiry into the condition of trade in important industrial centres, has furnished the following interesting comparison between the cost of cotton spinning in Oldham and on the Continent: 'England still possesses the important advantage of cheaper mill construction than the Continent, the United States, and the East, as might naturally be expected, seeing that the bulk of the European and Eastern trade is in the hands of English machine makers'.

"At the present time the cost of building a cotton mill in France is about 42s. 6d. per spindle." This is the estimate of Mr. F. MERTTENS, of Messrs. Merttens & Co., shippers, Manchester. Below appears a table from the "*Memoire du Lloyd Rouennaise de la Filature*," giving the comparative cost of mill construction in Oldham and Rouen, based upon extensive inquiries made a short time ago. Rouen is the French Manchester:

ROUEN.	OLDHAM.
Cost, 40s to 52s per spindle.	20s to 31s.
Mill, 28,000 spindles.	Mill 78,000 spindles.
Average counts, 28s twist French (= 33s English).	37s twist.
Weekly output, 23,760 pounds.	55,400 pounds.
Operatives, 126.	212.
Operatives per 1,000 spindles, 4.50.	2.69.
Wage per operative, 15s., 8 d.	£1, 1s., 11d.
Cost of labor (including management, etc.) in 70 hours, 0.99 d. per lb. for 28s.	Do. for 56½ hours. 0.86 per lb.

The cost of erecting a mill in England is really below the figures given above. A leading official of the Federation of Master Cotton Spinners offers me as his estimate 22s. 6d. per spindle for a fully equipped modern mill with the very best machinery, although it is possible to build a mill at a less cost than that.

Many mills in Oldham have, it is true, cost 30s to 34s a spindle, but they were built when the fever for mill construction was high. It has subsided now, and very few additions are being made to the productive capacity of Lancashire.

Mills of the most recent construction have naturally benefitted from the reduction in cost, but employers complain that the advantages arising from the improvements effected by Lancashire machinists have largely gone into the pockets of the operatives, and that their gain has been confined to the increased production from the same amount of plant.

About 220,000 operatives are now employed in the cotton spinning trade, in which there are over 45,000,000 spindles. Weaving employs about 315,000 operatives, working 660,000 power looms. Mr. MERTTENS estimates the output per loom per year at 1,866 pounds of cloth. Fifty years ago the quantity was only 1,234 pounds, and fifteen years ago it 1,806 pounds. The production per operative increased greatly until recently, when owing to the extra attention given to finer cloths it has fallen off to about 3,972 pounds per operative per annum, against 4,039 pounds in 1882. The average output in spinning mills is

6,660 pounds of yarn per operative. Fifty years ago it was only 2,754 pounds. It is a gratifying fact that England still beats the Continent in economical cotton production. The following table explains itself:

	Oldham.	Mulhouse.	Voszes.
Operatives per 1,000 spindles,	2.4	5.8	8.9

The Oldham and Mulhouse comparison given above does not refer to the same count of yarn, but when the difference is adjusted Oldham is still immensely superior. The number of spindles of a pair of self-acting mules is in England about 2,000 as a rule. In Germany it is from 1,300 to 1,600. In Lancashire one spinner with two helpers will look after 2,000 spindles. In England a single overlooker will control a mill of 60,000 to 80,000 spindles, the wage being 55s. to 60s. per week. In Germany if an overlooker has 15,000 spindles in charge he has his hands full. In Alsace and South Germany the number of spindles range from 10,000 to 20,000. In one of the finest spinning concerns in Saxony one spinner and four helpers are required for 2,000 spindles.

ESTIMATE FOR A COTTON MILL IN CHINA AND JAPAN.

We give below some interesting details relating to a 10,000 spindle mill estimate for a plant spinning China and Japan cotton which have been sent to us by our correspondent. The machinery which is specially constructed consists of 10,000 ring spindles, with all necessary preparation, and turns out 23,000 pounds of average counts per week of 72 working hours. The motive power consists of a compound steam engine of 350 horse power, two 28 by 7 feet Lancashire steel boilers, patent fuel economizer, and all necessary shafting, pulleys, stroes, etc., complete. The total deadweight of the machinery is 510 tons, and the shipping measurement 1,120 tons. Further details as follows:

Everything as regards machinery and stores, is furnished

complete, including sufficient mill stores for a six months' supply; also, all boiler seating bricks and blocks, non-conducting composition, bundling presses, to make 5 to 10 pound bundles; a hydraulic press, to make baled 400 pounds of yarn; main driving ropes and all strapping. Price, all complete, packed where required and delivered f. o. b. Liverpool or Manchester, £12,550; or c. f. i. Shanghai or any other Chinese or Japanese treaty port, £14,755. Detailed estimate on application, also samples of yarn spun on this machinery from China cotton and cloth made from same. The machinery consists of 1 opener, 2 double scutcher and lap machines, 31 carding engines, 2 grinding machines, 4 drawing frames, 3 heads of 5 deliveries each, 4 slubbings of 64 spindles each, 6 intermediates of 92 spindles each, 10 rovings of 128 spindles each, 40 ring frames of 250 spindles each, 40 reels, 2 yarn bundling presses, and 1 hydraulic yarn baling press.

If required, the whole of the iron work for the building in one story, viz., iron columns, rain spouts and gutters, corrugated roofing sheets, iron window frames, iron doors, ventilators, steam heating throughout the mill, window glass, and all small iron-work for the roof, f. o. b. English port, £2,865; or £3,360 c. f. i. Chinese or Japanese port. Weight 350 tons.

Another large building concern in England furnishes the following estimates of three classes of spinning mills of 50,000 spindles each:

Mill A. 50,000 spindles on average No. 32 yarn for print cloths would cost about $200,000 in the United States for *machinery* against about $110,000 in England.

Mid B. On average 60s Egyptian carded yarns, about $160,000 in the United States and $96,000 in England.

Mill C. On average 20s combed yarns, $460,000 in the United States and $280,000 in England.

They also submit the following schedule of machinery for the foregoing mills:

Mill A.	2	combined openers and scutchers.
	7	single beater scutchers.
	62	R. T. cards, 50 in. by 38 in.
	168	drawing deliveries.
	588	slubber spindles.
	1,536	intermediate spindles.
	5,376	fine roving spindles.
	24,720	mule spindles, 1⅜-inch gauge.
	25,000	mule spindles, 1⅛-inch gauge.
Mill B.	1	bale breaker.
	1	porcupine single beater opener.
	1	single beater scutcher.
	40	cards, 50 in. by 38 in.
	105	drawing deliveries.
	318	slubber spindles.
	1,200	intermediate frame spindles.
	5,200	fine roving spindles.
	50,000	mule spindles, 1⅛-inch gauge.
Mill C.	3	combined openers and scutchers.
	6	single beater breakers.
	6	single beater finishers.
	90	cards, 50 in. by 38 in.
	38	comber lap machines.
	38	ribbon lap machines.
	160	single nip combers.
	240	drawing deliveries.
	688	slubber spindles.
	1,690	intermediate frame spindles.
	4,988	fine roving spindles.
	50,000	mule spindles, 1⅛-inch gauge.

The same party also gives the following as actual cost of some of the details in the construction of a modern mill (spinning) of 80,000 spindles on No. 80s:

Excavations,	$9,700
Buildings,	97,000
Steam piping,	750

Boilers,	$8,250
Engines,	17,000
Shafting, belting, etc.,	20,000
Bobbins and skewers,	3,000
Card clothing,	7,800
Other supplies and fittings,	40,000

Machinery would cost in England from $2.00 to $2.15 per spindle without combers, and from $2.85 to $3.00 per spindle with combers, and four operations of roving machinery.

The foregoing figures have been inserted to give some idea of the cost of mill plants elsewhere than in this country, and form an interesting feature worth careful study.

In conclusion, it would seem that to establish any fixed rule for depreciating machinery applicable for all classes and departments of same, is practically an impossibility, and that the true value must always be found from the exact condition of the machinery, and the following ought to be considered:

First. As to the natural wear and tear.

Second. In comparison with what the same pattern of machines could be bought for in the market upon the time of valuation.

Third. Comparison with modern machinery of the same class in regard to production and first cost of same.

Fourth. The local conditions surrounding the machinery to be valued, its relation to the other classes of machinery in the mill.

In establishing the value of mill buildings and power plants, the same general rules should be followed. Different mill buildings, as well as different classes of machinery, do not depreciate or wear out in like progression, and some portions of carding departments may be run under some conditions far longer than other machinery in the same department, thus rendering any set rule practically valueless as applied to all machinery in that department and the plant generally. The subject is one of vital importance to the manufacturer, and one but comparatively little understood; and in cases known to the writer, where ex-

pert evidence has been introduced by either side in the case, there has been shown an astonishing variation in valuations as not only applied to complete mill plants, but to machinery and individual machines as well; showing more forcibly than ever that the valuation of a mill plant complete should be taken as a whole, or a unit, or tool, with which to produce at a profit, if possible, a fair dividend on the plant. Its original cost has no direct bearing upon its present value. We must look at the plant as it is, and what can be done with it in competing in the market and earning a dividend.

I most sincerely trust the subject matter may receive your most careful thought, and that it may be interesting enough to provoke discussion, and that it may receive attention at some of our future meetings.

REPAIR SHOPS.

F. M. MESSENGER, North Grosvenor Dale, Conn.

The manufacture of cotton goods embraces within its scope other lines of business, which are distinct trades in themselves, and while only contributary, seem to be essential to a complete system.

In these days competition compels us to guard against leaks in all departments; hence, it becomes more and more important that the mill manager acquaint himself with the details of these side issues, and determine as near as possible the best methods of practice in each. The general methods of our business are so well known and understood today, that success depends largely on the careful management of details.

It is our part, especially in this paper, to speak of "repair shops" or repair work. In the first place it is a legitimate question to ask, "How far can we go in the line of repairing and getting out new parts, with profit to the business?" Conditions, owing to location, might vary the correct answer to this question somewhat, as mills located in close proximity to the builders of the machines in use, could buy direct from the shops without the inconvenience of delay or expense of freights and express in getting supplies; but as machine builders never manufacture a complete line, and if they did few mills would wholly equip themselves with machinery of one make, this may not weigh as much in our consideration as might at first appear. It has been remarked that machine builders sell their machines

at cost, and depend on repair work for their profits; in some instances the prices charged would seem to confirm such an opinion. It is quite evident to the mind of the writer of this paper, that a well managed repair shop is a paying institution, and that the new parts required for repairs may largely be finished at the mills at a profit; and that every cotton manufactory of any considerable size, should have connected with it a first-class shop. To be intelligently carried on it should not be lumped in with the general business, and a sort of guess estimate made of the running expenses of same, but it should be handled as an entirely separate business, charging a reasonable sum for its power, office, superintending, rent, taxes, insurance, etc. This plan has been followed at the mills of the Grosvenor-Dale Company for about five years; and we find it leads to the study of the best methods of doing the work, and stimulates to promptness and despatch in its execution. All raw materials are charged against the shop as well as its labor. Finished work is placed in stock for delivery, as needed, to the several departments, the shop receiving credit at market prices. All repair work such as mending broken, or applying new parts, or any work of a nature that produces nothing, is charged to the several departments where it belongs, at the rate of man's time, plus a certain percentage sufficient to cover the rent and other charges against the shop, including use of tools, etc., and bills are rendered weekly against the several departments.

A well appointed repair shop should consist of a machine and blacksmith shop, a wood working or carpenter shop, and if tenement work is to be done a tin shop will pay. Each shop should be equipped with all necessary machines of the best. The selection and care of proper tools is a matter of great importance. Any shop employing half a dozen hands should have its tool room, and it should be under the care of one man; he can have a lathe inside, and be kept busy on light work. A checking system should be used, and any tool absent should have in its place a check denoting who has it; this avoids losses

and locates the responsibility for breakages. Without some system of this kind the cost of tools is likely to be very large.

At the mills quoted above the time of each workman is kept on an individual sheet, subdivided to show where his labor is chargeable for each day and its different parts; this subdivision of time has thrown much light on the pernicious practice of Sunday work, which is always and ever a "delusion and a snare"; and "whosoever is deceived thereby is not wise". Covering a period of four years, Sunday work has been practically abandoned, and we believe it would be safe to say with a saving of hundreds of dollars each year to the company. With two or three exceptions, where men must either work a few hours on Sunday or suffer from the intense heat in a boiler, boiler flue or an engine cylinder, absolutely no work has been done on Sunday. During this period of four years several hundred thousand dollars have been expended in enlargements and improvements, which involved great changes in motive power, heavy mill gearing, shafting, etc., and all without Sunday work or stopping of the mills, with the exception of one week. Sunday work is a kind of chronic disease in some establishments; and a decided and heroic treatment, effecting a cure, would yield good returns by a better general health of the whole plant.

While a repair shop should not be run with the sole end of profit in view, with the mill saving freight and express charges, the shop *should* be entitled to whatever profit in cost of its goods it may be able to make. Patterns to be used but once should not be made, but the castings obtained elsewhere (if they can be), either rough or finished. If not obtainable, the cost of patterns should be charged to the job in hand; but all patterns for stock work should be charged to the shop. Pieces requiring special tools should be obtained "finished," if but few are used, but for regular stock work, tools should be made or bought, and charged to the shop. We have at the mills referred to, a catalogue of patterns; these patterns are photographed and blue printed, each having its number, and these are placed in a book for the purpose. These books are in triplicate, one

being kept at foundry, one in shop and one in office. All castings are ordered by catalogue page, and pattern number, thus avoiding the constant necessity of shipping patterns back and forth. With the right equipment and a thorough system, most of the goods we use can be done profitably, and if we find that machine parts which are used in considerable quantities cannot be profitably made in our shops, we may rest assured that either our tools and methods are behind the times or our shop is not well managed.

We believe that in repair work (as in any other) a correct system will uncover faults and call for a remedy; and that any shop which is being run haphazard, if systematized, would show many a leak that can be ill afforded in these times.

MILL REPAIR SHOP.

D. D. DONOVAN, Providence, R. I.

The subject of a properly equipped repair shop for the mill is worthy of the serious attention of the mill manager. The most curious and important part of this question is that an erroneous idea has almost always prevailed, and that is that a repair shop is a source of constant financial drain on the factory and furnishes no return for the money that is laid out to thoroughly equip it to do the work in the most advantageous manner, both in point of time and quality of work. How this idea originally crept in and how the tradition has been kept up, is a mystery to a mechanic unacquainted with cotton or woolen factory business. There is just as much chance for improvement in the repair shops (and in the writer's judgment, a good deal more) than there is in the factories themselves. So far as my observation goes, very little encouragement has been given to men who have had charge of this department, which has fostered indifference, and many times, incompetency.

The writer of this paper has had opportunity to visit many of the mills in the New England States, and in very many of them he has found that first-class facilities for making repairs quickly were noticeable by their absence, while on the other hand any improvement in the machinery for the manufacture of the product of the mill is adopted just as soon as its adaptability is established.

In this age of competition and close margins, it is not only of the utmost importance to have the mill equipped with the most

modern machinery, but it is of equal importance to keep the machinery running up to its very highest efficiency. To accomplish this result, preparation must be made, so that when the inevitable accident occurs it may be remedied in the best possible manner and in the shortest possible time, and the work of production resumed. I do not refer here to the possibility of a break-down of the engines, or to any other accident that would cause a shut-down of the mill, but to those minor accidents that interfere with the regular working of the plant, and for grappling with which and making right as quickly as possible, a regular corps of workers is employed. To effect the most speedy remedy for these troubles, facilities should be provided beyond what are found in many of our mills. This may mean the outlay of a few hundred dollars, from which no direct return is perceived by the management, but this outlay will show at the end of the year on the profit side of the balance sheet.

The master mechanic and the men employed in the repair shop are thoroughly conversant with its needs, but they are not always successful in impressing the managers with the fact that the proposed expenditure of a few hundred dollars for new tools will mean a great saving in the time occupied in making needed repairs, as well as in improving the quality of the work.

The engine lathe, the planer and the drill press, find places in all repair shops. If these tools are kept in good condition they are an important factor in any shop, and some years ago they would have been considered about all that was required. When we consider the rapid strides that machine-shop equipment has made in the last few years, and how necessary it is to take advantage of the latest improvements in order to keep up with the procession that is ever moving onward and upward to a higher degree of efficiency in the construction of machine-shop tools, we must note the fact that the most successful firms are the ones that adopt the highest class of machines and the most approved methods of shop management. This will apply with equal force to the mill in all its departments, as well as to those engaged in the manufacture of machine tools.

For the mill repair shop where repairs must be made with the greatest possible despatch, the universal milling machine will be found an invaluable help; its adaptability to a large range of work makes it indispensable in an up-to-date shop. This machine has become so well known among mechanics that a description of it here will not be necessary. The large number of them sold has enabled the makers to manufacture the machine at such a figure that no mill can afford to be without one.

The vertical attachment recently applied to the milling machine has greatly increased its scope and efficiency at a slight additional cost.

The automatic gear cutting machine is another tool to which your attention is called. As the replacing of gears is an important element in mill repairs, the most efficient means should be at hand for the purpose when they are required.

A stock room, where parts of machinery that are liable to give out could be made up and kept on hand for use when required, would greatly facilitate the making of repairs, for the cost of the part is very slight as compared with the loss occasioned by the stoppage of the loom or other machinery while the repairs are being made. How much time is often consumed in ordering a casting for a gear blank from the foundry, chucking the hole, turning in the lathe, and cutting the teeth in an old rattle-trap gear-cutting machine, the only excuse for retaining which in the shop is that there is not enough work for a machine of this kind to warrant purchasing a new one, no thought being given to what it costs in loss of time to retain the old tools.

The practice among all successful machine builders is to replace the old tools with new ones as the efficiency of the old becomes impaired, and the same practice prevails in the mill so far as the mill machinery is concerned, but some persons seem to think that the machinist having a hammer, a cold chisel and a file, with possibly an old lathe, is provided with all the tools required to do the repairs in the mill. If the machine shop and

the mill require so much care to keep the working machinery up to a high standard of efficiency, will not the same principle apply to the mill repair shop, from which so much is expected when its services are in demand?

Drills, reamers and measuring instruments can now be purchased at such reasonable figures that no shop can afford to be without a supply sufficient to meet all requirements. For quick and accurate measurements the micrometer caliper furnishes one of the best means. By its use parts may be duplicated with an exactness that can be obtained in no other way.

The subject of reamers is worthy of a little attention; the day of the old solid reamer is gone by, except as a machine or roughing reamer. For finishing holes and keeping to uniform sizes the adjustable-blade reamer takes its place, and, as this style of reamer may be purchased at only a slight advance in cost over that of the solid ones, their use will be found to be a saving.

In the Brown & Sharpe Manufacturing Company's works the adjustable-blade reamer is very extensively used, and you will find the firm willing at all times to give any information that a person may desire in regard to their manufacture and use.

In addition to all I have said, I believe it is true that if a well equipped repair shop was connected with every mill in this country that is worth trying to keep alive, much original work could be done if intelligent, technically educated young men could be kept in that department. There are so many young men passing through our technical schools that it is not a hard matter to secure one, now and then, who would make a mark for himself and for his employers if he had the advantages of proper appliances in the various branches of his labor to assist him. Many original improvements would be made which could not be made so well by anyone as by the man who is in close touch with the mill and all its interests. One or two concerns are already looking forward to that improvement and are taking steps in that direction. It is my belief that all who want to keep abreast of the times will follow their example.

In glancing over the papers presented at the previous meetings of your Association, the reader is impressed with the great care given to their preparation, and the interest shown in them by the discussion that followed their presentation proves their value to those present, and encourages in the writer the hope that this subject also will receive the share of attention that its importance merits, of which you must be the judge.

Permit me to thank the Association for the privilege of being present and participating, in however so slight a measure, in advancing the great object which you have in view.

THE PROPER CONSTRUCTION AND USES OF ECONOMIZERS.

*HENRY G. BRINCKERHOFF, Boston, Mass.

The principle of heating the feed water in a separate vessel, quite apart from the boiler, and thereby utilizing the heat in the waste gases, is the function of flue heaters, more commonly called "economizers", leaving the boiler to supply chiefly the heat units necessary for the latent heat of steam. Taking the important steam users throughout the world, this is a recognized and universally adopted practice. Economizers are not only considered a necessary part of the equipment of every steam plant in Great Britain, but are in operation all over the Continent and as well known in the spinning mills of Russia and India; equally noted among the gold mines of South Africa and the textile factories of China and Japan; while throughout the large manufacturing districts of the United States they are already extensively adopted.

The great loss of fuel as noted between the heat value of coal and the heat taken by the water, has been observed for many years, and numerous have been the appliances to recover it, the simplest and best method appearing to be to pass the waste gases on their passage to the chimney through pipes containing water, and thousands of such pipe heaters have been constructed by nearly as many makers, yet with an exception of one or two, they have all failed. Disappointment has attended the result of so many economizers or flue heaters, that we find that some people have become skeptical and condemn them all, and state

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it to be impossible to build one which will last and give satisfactory results.

The failure of so many flue heaters is attributed to three causes:

First. Not being made of *cast iron*, the only practical metal to withstand the corrosive action of sulphurous gases.

Second. Lack of capacity. It takes *time* to absorb enough heat to make them of practical value, hence the water should be from thirty to fifty minutes surrounded by waste heat.

Third. Lack of *automatic cleaning of pipes.* Soot being a non-conductor of heat, a slight coating on a limited capacity economizer would end its usefulness in a few hours after it had been thoroughly cleaned.

The late Mr. EDWARD GREEN was the first to develop a flue heater embodying these essential features, and a word as to this well known inventor and the business he established, will be of interest.

Mr. EDWARD GREEN was born in 1799, in Wakefield, Yorkshire, and died in the year 1865, and was succeeded in the business he founded by his son, Sir EDWARD GREEN, Bart., the present head of the firm, who was joined by his second son, Mr. FRANK GREEN, in 1883.

Before the late Mr. GREEN began to devote his whole time and energy to the apparatus that bears his name, he was engaged in general mechanical work and in the construction of large pumping engines for the deep coal mines of Yorkshire, as well as others for draining the fens in Lincolnshire and Norfolk.

Though the patent for his fuel economizer was taken out in 1845, it was not until after the great Exhibition of 1851, that steam users seriously recognized the great opportunity for saving that was, by its means, placed within their reach. From that date, however, its success was assured, and the large amounts of coal economized by those steam users who gave it a trial, forced it upon the attention of the remainder of the manufacturing community, with the result that the advantages of the economizer became more and more widely known, and at length almost

universally recognized, so in the present day the invention is used by boiler owners all over the globe.

Briefly stated, the further and most important details for a well designed economizer should be the absence of all "made" or packed joints inside of the brick work.

Second. Easy accessibility to every square inch of internal surface.

Third. The vertical pipes should be forced into the top and bottom headers by powerful hydraulic pressure, making the joints metal to metal, which is a far superior piece of workmanship than fitting the pipes in loosely into the the boxes or headers and then rusting in by the use of iron filings and sal-ammoniac.

Finally, applying a rigid test to each section of 350 pounds to the square inch.

A well constructed economizer built under the specifications described should last twenty years under ordinary care and attention. After it has reached that age it can be easily repaired and parts renewed so as to last indefinitely, as an umbrella retains its original individuality which has been fitted with new stick, spokes and re-covered.

The care required consists in blowing off daily at the same time as the boilers. Every three months the soot should be cleaned out of the chamber below, which at such an interval is about an hour's job. Once a year, at least, the caps should be taken off and the interior of the pipes inspected. If the water is bad this should be done oftener. There is no reason why the scraper mechanism should not run smoothly for years. This used to be a troublesome point with some of the early makes of economizers.

The general use of compound condensing engines in modern steam plants has enlarged the field and extended the use of economizers, as the exhaust steam is not available for heating feed water except to a limited degree.

A common practice some years ago, was to take a portion of the exhaust steam for heating feed water, obtaining thereby a

temperature of about 210 degrees, while with the compound condensing engines it is not generally feasible to get much over 130 degrees, thus making a direct loss in economy for the compound plant as compared with the older ones, to the extent of 7 to 10 per cent. of all the coal consumed, offsetting by that amount the gain obtained by compounding, whereas the higher temperature of the steam demands a higher temperature of feed water, instead of lower, for the proper efficiency and durability of the boiler.

The advantages of the economizer may be summarized as follows:

First. It secures a genuine saving in fuel expenditure by recovery of heat otherwise entirely lost.

Second. It increases the capacity of the boiler plant.

Third. It saves repairs to the boilers by relieving them of much of the strain of expansion and contraction caused by colder water entering the boilers and mingling with the hotter contents.

Fourth. It prolongs the life of the boilers for the same reason.

Fifth. It saves much cleaning of the boilers, thereby increasing their efficiency because of the precipitation of feed water impurities in the economizer, many impurities not being freed from the water until a high temperature is reached. This fact, and the slow movement of water in the economizer, is the reason that this apparatus removes so much more foreign matter from the feed than the other types of heaters.

Sixth. The economizer is especially desirable where the work fluctuates. A large amount of power suddenly withdrawn drops the boiler pressure, while fresh coal in the furnace and cold feed water entering the boilers make matters worse, a condition frequently observed in bleacheries and electric plants. Gauge pressure is seldom observed to drop when an unusually large amount of feed water is being forced into the boiler, where it has been previously heated in an economizer.

Seventh. Any use hot water can be put to in processes of manufacture can be obtained free of cost by drawing the pure

hot water from the economizer; particularly bleachers and dyers take advantage of this opportunity for their kiers and dye tubs. Where mills are heated during the winter by hot water, a part of the economizer can be included in the circulating system, supplying the heat necessary, entirely by the waste gases. This has been done by some large mills, the Grosvenor-Dale Company, a good representative of our New England textile mills, being one of them.

In conclusion I may say, it is the general opinion of those owning economizers, and others having them in their charge, that it makes easy working conditions in the boiler room.

SOME VITAL POINTS CONCERNING FIRE PROTECTION OF MILL PROPERTY.

W. H. STRATTON, Hartford, Conn.

The reduction of hazard and minimizing of losses from fire in cotton mills is at this time almost wholly a mechanical problem. It is not a new subject to cotton manufacturers; in fact the present advanced methods of constructing mill buildings and installing apparatus for extinguishing fires are largely due to the recognition and encouragement of all meritorious efforts to that end by cotton manufacturers, especially among the larger mills of New England.

The hazardous elements in cotton and mixed stocks have ever been recognized; watchfulness in handling, working, and general care and cleanliness have always been cardinal features in mill administration, and every device that could lessen the danger from fire has been warmly welcomed and generously adopted.

When the automatic sprinkler was brought out in 1875, its merit was quickly recognized by a New England cotton manufacturer, who equipped all of his departments where loose stock was worked, in fact all but the weaving department. This was long in advance of any record of actual fires extinguished, or acceptance by underwriters, and before any inducement or reduction in rate was established.

The excellent record of the automatic sprinkler in controlling several thousand fires, and the enormous values thus actually saved, together with its influence in reducing the cost of insur-

ance, emphasizes the wisdom and forethought of those who first encouraged its use.

It is not expected that the special points hereafter referred to will present new or novel features to all; but the opportunity to observe as a specialty many peculiar conditions contributing to fire hazard and the usual tendency to enlarge upon the good points of fire apparatus, suggests the benefits of accumulating and submitting some of the bad features, and this effort is to that end.

The rapid improvement in the last few years, both in fire apparatus and the methods of installing, has practically created a new art, "THE ENGINEERING OF FIRE PROTECTION", and the refinement and perfection of the original simple automatic sprinkler equipment has called into use many important auxiliary features and apparatus, as well as developed many weak points referred to under separate headings below.

POST INDICATOR VALVE.

In the earlier application of fire apparatus no attempt was made to guard against the crippling of an entire equipment by the breaking of water mains within a building. Therefore, one of the most important steps has been the provision of a safeguard against such disaster by the introduction of gate valves with post indicators at safe distance from the buildings controlled, and in accessible places. Many of the older equipments lack this highly important feature, but all modern installations should include its intelligent application.

ROTARY PUMP.

There are many cases on record of the complete destruction of mill properties due to the poor and inaccessible arrangement of fire pumps; this is more especially noticeable where the rotary pump driven by water wheels is the main safeguard. The rotary pump itself is a very treacherous machine. It requires enormous power, operates under high speed and excessive journal pressure. It is necessarily located immediately at

the water wheel. It is often neglected and found badly rusted in the buckets and bearings, and rarely prepared with the necessary facilities for applying the excessive lubrication it demands. Furthermore, in many cases they are so geared that it is necessary to run all the mill machinery when operating pump, and where spur gears are used the wheels must be stopped to throw in the gear before they can be brought into service.

Perhaps the location is equally as important as any feature in connection with this apparatus, and yet we find them in cold pits, unprotected by automatic sprinklers, and where it is necessary to go through dark and dangerous places under mills, and where the smoke from slight fire might fill the space necessary to travel, so that the pump could not be reached at all. There are records where slight fires have produced these conditions and complete destruction of whole properties followed. Therefore:

The pump should be located in an accessible place.

Geared so that it can be run independent of mill machinery.

Enclosed or cut off so smoke cannot prevent its being reached.

It should be protected with automatic sprinklers. Every rotary pump should have an independent gate and check valve; the gate for a positive shut off, the check so that water from other sources cannot be lost through the buckets or by turning the pump backwards, and to prevent washing of hard substances into the buckets which is liable to break them when brought into operation.

STEAM PUMP.

The steam fire pump is usually well cared for, and naturally can be better located, both as to protection and accessibility. The excellent pumps now in use, known as the "Underwriter's Pattern," if properly connected, are decidedly better than the rotary, but they must be as well cared for as a steam engine. Of necessity, a large number of these steam pumps are operated by an automatic regulator, usually for small demands, with the

understanding that if kept in motion slightly it is advantageous; but this custom has developed the fact that a pump so arranged will gradually shorten its stroke, wear the cylinders and plungers unequally, and is, therefore, liable to serious damage, if not total disability when needed in case of fire. To overcome this, and to save wearing out an expensive machine, a small independent pump should be used to maintain pressure and furnish water for daily demands, and when the main fire pump is used, it should be run at full stroke, cylinders should be kept well oiled, and drips normally left open or constantly drained.

STEAM PIPES.

In keeping with the principle of protecting large water mains by post indicator valves, the arrangement of steam pipes should be such that all the pipes leading from boilers for power or other use should be controlled by one valve on boiler yoke and a separate and independent connection should be made to the fire pump. Furthermore, the fire pump should be so connected that it may be used to fill the boilers.

RELIEF VALVE.

Every fire pump should be provided with a relief valve. The old-fashioned lever safety valve with weight is a very treacherous and dangerous device. It has been found rusted so it would not operate, and its very construction invites calamity by the possibility of intermittent action which has been known to shift the weight and bring the lever down with sufficient force to break the hinge pin. When this happens, there is no way of holding the pressure, and the pump will simply blow off water through the broken safety valve, and cripple the entire fire apparatus.

The spring or pop valve is the only safe device to use; furthermore, it can be obtained of ample capacity to effectually discharge the excess of water from a fire pump, whereas it is questionable whether some patterns of lever safety valve will

rise enough to discharge sufficient water to give effectual relief if all other outlets are closed.

CAST-IRON WATER MAINS.

In many instances it has been found that cast-iron water mains were not of proper area when installed, and the effect of corrosion constantly reduces their carrying capacity. Large pipes are, of course, more expense at the outset, but it is economical to install them. All pipes laid underground should be purchased under a guarantee, both as to pressure and hammer test, the same as is customarily required in large contracts for public mains. It is now the custom to demand a certificate of inspection from an independent bureau, which costs about 30 cents per ton. Where a few hundred feet are purchased by a mill without this precaution they are liable to be supplied from the cullings thrown out by inspectors, and thus millions of dollars may be exposed to destruction by the introduction of one length of imperfect pipe. Several instances are recalled where ordinary pump pressure has developed weak points in mains, blowing out large pieces that would have been disastrous in case of fire.

Wherever it may be necessary to lay cast-iron water main with caulked joints in newly filled or made ground, or where there is any liability of tide water rising and falling, special preparation should be made to protect against damage, —

First, from settling in made grounds which will open the lead joints or break off the pipes.

Second, washing out of earth by tide water and the possibility of freezing under such conditions.

Recent experiences emphasize the importance of careful consideration of these features.

WROUGHT-IRON PIPE.

Special attention is directed against the use of wrought-iron pipe under ground. Owing to the thinness of the shell and rapid deterioration when the scale is once started, its life and service are so short and its strength so questionable, that from an economical point, if no other, it should never be used.

SHEET–IRON PIPE.

Sheet-iron pipe lined and covered with cement should not be installed where high pressure or shock from water hammer and vibration of pump are possible. An equipment has been installed recently where the entire pump and hydrant service depend upon the stability of this uncertain class of pipe, and at least half a million dollars is at stake.

FIRE HOSE.

The fire protection of a cotton mill requires a large outlay for pumps, cast-iron mains, hydrants, etc., and in order that an expensive equipment thus provided shall not be rendered useless at the only time when needed, great care should be given to the selection of fire hose. The most durable and therefore economical hose to purchase is that known as "Underwriters' Standard", which is 2½ inches in diameter, of a strong, closely woven fabric, lined with high grade rubber tube. Such hose will stand the pressure, and offers the proper carrying capacity with a minimum loss from friction, and when once installed and properly cared for will last long enough to pay for several cheap equipments.

It is highly important that hose couplings should be interchangeable with those of the nearest assistance from either fire department or other mills.

HOSE HOUSE.

Hose should be kept outside of all heated buildings, to avoid killing of rubber, and in a dry place to prevent mildew, the best arrangement being on slatted shelves in a house about six feet square, built over the hydrant. All appliances should be kept in this house so that upon opening the door, the hose (already being attached) can be run out and used without loss of time to gather the implements, attach hose and get into operative condition.

TANKS.

Where the primary source of supply for automatic sprinklers consists of an elevated tank, it should not be used in any way for daily service. In some instances they have been found so arranged that all water for general use is first pumped into the sprinkler tank, then overflows into the daily service tank. It is claimed for this arrangement that it insures the sprinkler tank being always full, but the possibility of depositing sediment in the sprinkler tank and pipes would seem to outweigh the advantages thus claimed. Greater security can be obtained by reserving the sprinkler tank exclusively and independent from all other service, and providing proper tell-tale and usual precautions for keeping it full.

INDICATOR VALVES.

All valves controlling supply of water for fire apparatus should be of the indicator pattern, and where located inside buildings for controlling sprinklers, they should be made accessible by permanent ladders and platforms, so they may be promptly reached and operated should the flow of water be caused by accident or create unnecessary damage after a small fire; also to guard against the unnecessary loss of water where storage tanks furnish the primary protection of the property.

CHECK VALVES.

Where check valves are required for fire protection, it is absolutely necessary that nothing but metal valves and seats should be used. At a pump trial recently made, an 8-inch swinging check was found with a valve of some special composition, such as rubber, plumbago and asbestos, evidently for use in connection with steam. The frequent shocks produced by the action of the pump cut the packing out and let the valve ring down into the casting, locking itself shut and effectively resisting in this position one hundred pounds pressure from the pump; when relieved and opened, it immediately locked itself

open quite as securely. This result cannot occur where the high grade, all-metal ground valves and seats are used.

HYDRANTS.

No special pattern or make has been found that seems to embrace all the desirable features. It is therefore necessary to look carefully into all of the following points, both in selecting the device and making arrangements for installing them.

They should be selected, if possible, with some idea of repairing valves without digging up.

They should be substantially constructed and provided with frost cases.

They should be arranged to shut off below frost and properly drain.

Where set in clay or close soil, broken stone or other artificial drainage should be provided and proper foundation and packing of stone should be placed around the post to prevent blowing off the joint if the drainage washes away the retaining earth.

The outlets should be fitted with hose threads to interchange with those from which hose and assistance may be obtained.

All the wrench heads should be alike, so one wrench will open every hydrant on the premises, and in this feature they should interchange with the implements of the nearest assistance, either fire department or other mills.

The inlet and the post should have an area in excess of all theoretical demands.

Special attention is called to the practice of some in making three-way hydrants with 5½-inch valves. Except in rare cases hydrants should never be fed by less than a 6-inch pipe, and should have valve inlet full size of main leading to it.

The independent gate hydrant is not desirable. The small valves are liable to be broken and the stems twisted off, to which is the additional objection on the part of some that the place for attaching the key is concealed and might cause delay, if not render the hydrant absolutely useless in the dark. The ordinary hydrant, with hose valves on each outlet, is strongly recommended in preference to the independent gate pattern.

PRIVATE FIRE DEPARTMENT.

Every mill should have a proportionate number of its men drilled in the use of fire apparatus, more particularly the hose. This not only increases the efficiency of protection, but avoids the liability of accident and the maiming of inexperienced men in holding fire streams under high pressure. They should be regularly drilled to become expert in the handling of hose under actual fire pressure.

FIRE DOORS.

In many places it is necessary for the convenience of manufacture and construction that openings through otherwise fireproof walls and separations should exist. In such cases, the application of 2½-inch pine doors covered with lock jointed tin, and hung on substantial hinges or tracks, applied at both sides of wall, should complete the fire barrier, but the door and all trimmings must be perfect to be of value.

WATCHMAN SERVICE.

When it is considered that every manufacturing plant is for the greater part of the time (nearly two-thirds) solely under the care of watchmen, the system of patrol and record of same, the selection of the men themselves and their knowledge of all fire-fighting facilities of the plant, should be most carefully considered and applied.

It may be reasonably claimed that the night watchman service is rarely adequate in proportion to the property. One man would be almost helpless and could best devote his time to summoning help by an established alarm system. A property, having as its main source of fire service a rotary pump, would require at least one man to start, oil and care for pump, one man to attend to each hydrant, and from one to six men to handle and operate each fire stream. To be effective, every one of these men should be particularly well trained, yet very few mills are found where the watchman service is composed of sufficient men to properly operate pumps; hence the suggestion

that the first efforts be applied to summoning help and furnishing volume pressure of water for the operation of automatic sprinklers.

Such number of men as may be determined upon should be strong, active, and of more than ordinary intelligence. They should have full knowledge of the construction and occupancy of all the buildings, know where all the hazardous materials and special features of danger exist. They should fully understand the operation of all fire apparatus, be able to find their way through any part of the property when filled with smoke, and know all the valves in connection with steam, water and fire protection, their use and location so they could find them in the dark and give directions to all the assistance that may be called to their aid. They should know the foremen or chief men of the several departments, as well as the executives of the property, and also be fully posted as to the limit of their authority in case a public fire department should come upon the premises.

A fire occurred a short time ago, about one o'clock in the morning, in a property where a large force of night watchmen was maintained. Some of these men had never seen any of the officers, being brought only in contact with the men in charge of the watchman service; consequently, they refused some of the officials admittance to the mill yard and interfered with the public fire department, and being unable to speak English could neither give information or take instructions nor work to any advantage; in fact they were a source of confusion and delay and contributed seriously to the extent of the loss.

It will be observed that no attempt has been made to analyze any one of the points referred to. Each one is a subject in itself, susceptible of extensive treatment, but if they may be accepted as reasonable hints and draw attention to the consideration of any feature that may have escaped notice, the object of the suggestion has been fulfilled.

TOPICAL QUESTIONS.

87. What is the maximum length to put 100s on bobbin?

No discussion.

90. Do you consider it practical to spool No. 120s yarn with the Wade bobbin holder?

Mr. JOHN ECCLES. The topical question for discussion is: "Is it practical to spool numbers as fine as 120s yarn with the Wade bobbin holder? I feel sure this is one which will interest some of our fine spinners who spool these counts. All ours have been spooled on the bobbin holder referred to, but have had to reduce the speed very greatly to do this. We find difficulty in the holder on account of the uneasy or wabbling motion causing sudden jerks and strains on the yarns, especially when the bobbins get small, as they revolve more rapidly at this point.

The introduction of the light wires was quite an improvement to the spooling of the finer numbers; yet I feel there are better systems for handling these.

We would like to hear from Messrs. DRAPER, whose knowledge, without doubt, far excels any other, as they are constantly in touch and know of about all the best modes, as most every manufacturer looks to them for the very latest improvements. It will interest us to hear from them on this topical question. In doing so we are like the son going to his father for wisdom and direction.

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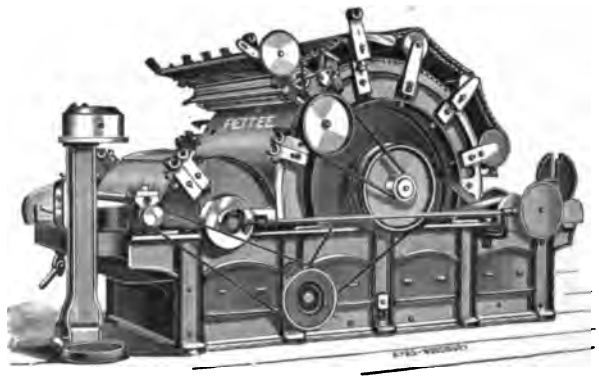

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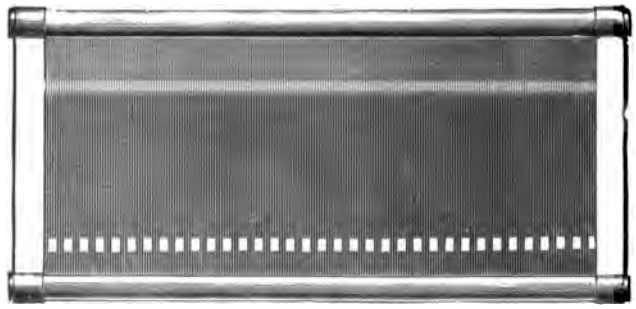

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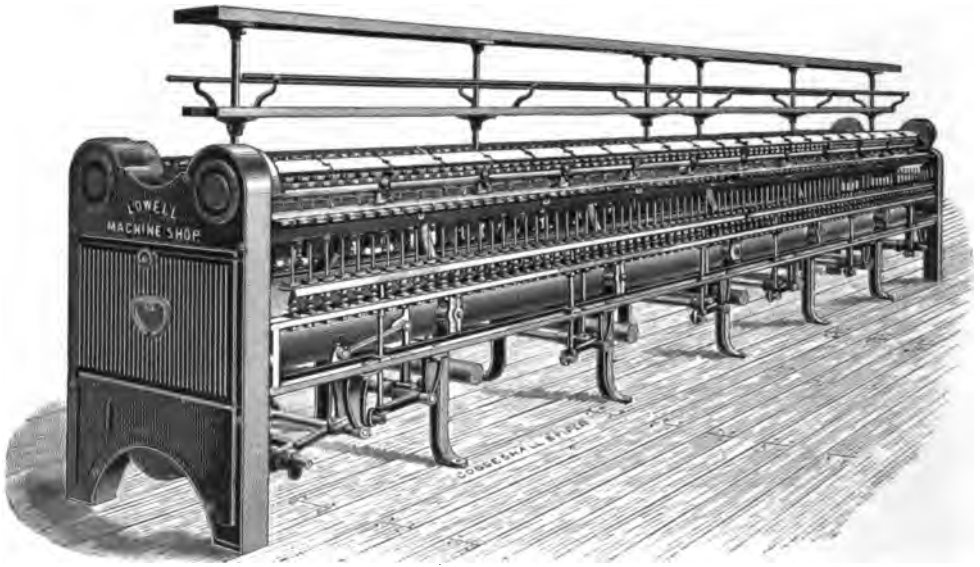

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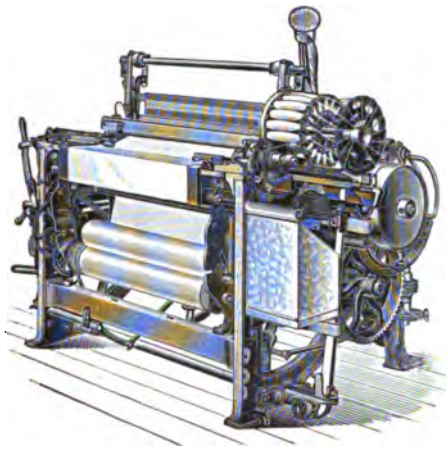

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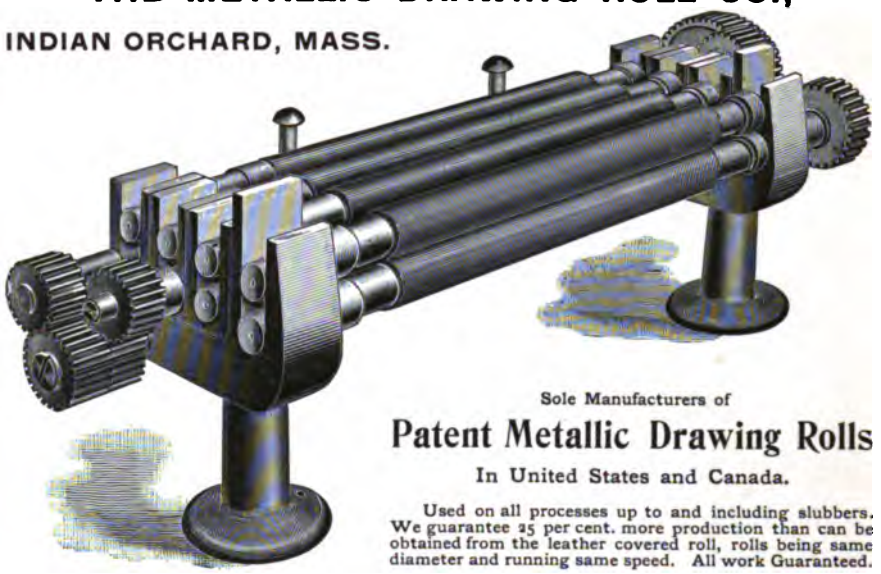

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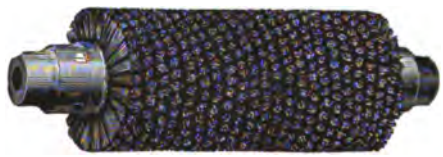

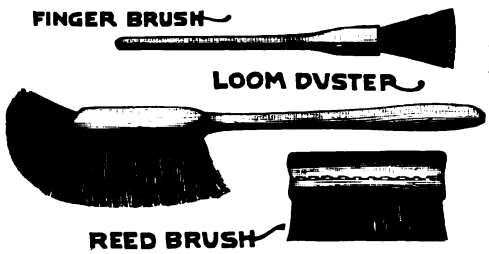

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NO. 63.

SEMI-ANNUAL MEETING.

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